Errata

Title & Document Type: E1725C / E1741A Time Interval Analyzer - Getting Started Guide

Manual Part Number: E1725-90011

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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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HEWLETT PACKARD

Getting Started Guide

HP E1725C/E1741A Time Interval Analyzer

Includes information on:

- HP E1725C Time Interval Analyzer
- HP E1741A Time Interval Analyzer Software
- TIA User Interface Software

Getting Started Guide

This guide describes the HP E1725C Time Interval Analyzer and provides getting started information for the HP E1741A Time Interval Analyzer and the TIA User Interface software.

HP E1725C/E1741A
Time Interval Analyzer

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Manual part number E1725-90011

Certification and Warranty

Certification

Hewlett-Packard Company certifies that this product met its published specification at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (formerly National Bureau of Standards), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Warranty

HP warrants HP hardware, accessories and supplies against defects in materials and workmanship for a period of one year from date of shipment. If HP receives notice of such defects during the warranty period, HP will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or like-new.

HP warrants that HP software will not fail to execute its programming instructions, for the period specified above, due to defects in material and workmanship when properly installed and used. If HP receives notice of such defects during the warranty period, HP will replace software media which does not execute its programming instructions due to such defects.

For detailed warranty information, see back matter.

Safety Considerations

General

This product and related documentation must be reviewed for familiarization with this safety markings and instructions before operation.

This product is a safety Class I instrument (provided with a protective earth terminal).

Before Applying Power

Verify that the product is set to match the available line voltage and the correct fuse is installed. Refer to instructions in Chapter 1 of the Manual.

Before Cleaning

Disconnect the product from operating power before cleaning.

Safety Earth Ground

An uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

Warning Symbols That May Be Used In This Book

Instruction manual symbol; the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.

Indicates hazardous voltages.

Safety Considerations (contd)

Indicates earth (ground) terminal.

or

Indicates terminal is connected to chassis when such connection is not apparent.

Indicates Alternating current.

Indicates Direct current.

WARNING

BODILY INJURY OR DEATH MAY RESULT FROM FAILURE TO HEED A WARNING. DO NOT PROCEED BEYOND A WARNING SIGN UNTIL THE INDICATED CONDITIONS ARE FULLY UNDERSTOOD AND MET.

CAUTION

Damage to equipment, or incorrect measurement data, may result from failure to heed a caution. Do not proceed beyond a *CAUTION* sign until the indicated conditions are fully understood and met.

For additional safety and acoustic noise information, see back matter.

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In This Guide

This book is the getting started guide for the HP E1725C and HP E1741A Time Interval Analyzer. It consists of a table of contents, this preface, five chapters, and an index.

This preface contains the following information:

- Guide Organization pg. viii
- Description of the High Performance Time Interval Analyzer pg. ix
- Available Software pg. x
- Software Characteristics pg. xi
- Option 002 HP E1725C TIA Hardware Configuration pg. xii
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Guide Organization

Table of Contents

In This Guide (this preface) introduces you to the getting started guide, and provides general information on the HP E1725C/HP E1741A Time Interval Analyzer (TIA).

Chapter 1, "**How to Begin**," provides complete system requirements and information, and step-by-step instructions on how to assemble and start operating your TIA.

Chapter 2, "**Learning About the On-line Help**," provides instructions on how to use the online help information that comes with the software.

Chapter 3, "**Practice Using the TIA Software**," provides a short tutorial that teaches you how to set up the TIA to acquire and analyze measurement data without the need for an actual signal to measure.

Chapter 4, "**Demo Waveforms**," provides detailed demonstrations about measuring and analyzing actual signals. Data files are included with your software to be used as examples to illustrate key points.

Chapter 5, "**General Information**," provides information on how to contact HP for parts information. A brief parts list is included in this chapter.

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Description of the High Performance Time Interval Analyzer

The HP E1725C Time Interval Analyzer series provides new insight into the timing performance of disk drives, tape drives, heads, media, and optical drives. This TIA series is designed specifically for the data storage industry.

There are several possible configurations for the software associated with the HP E1725C. This guide covers the HP E1741A Time Interval Analyzer software and the TIA User Interface software. Check the label on the disks to determine which type of software you have.

The TIA User Interface software and the HP E1741A software are very similar, the only difference is that the HP E1741A has added analysis capabilities for data storage test measurements.

If you have the HP E1741A software, this guide is equally applicable whether you ordered it as the HP E1725C Option 141 or as the HP E1741A.

Other software that can be used with the HP E1725C is not covered in this guide. The HP E1747A Timing Pattern Analysis software provides added capability to the HP E1741A, so if you have the HP E1747A, you might want to begin with this guide and then proceed to the *HP E1747A Timing Pattern Analysis User's Guide*.

Available Software

The following table summarizes the available software for use with the HP E1725C Time Interval Analyzer.

HP E1725C TIA Software	Documentation Sources
Option 141 (separately orderable as HP E1741A)	This guide and online help
Option 147 (separately orderable as HP E1747A)	This guide, separate user's guide, and online help
TIA User Interface	This guide and online help
Any other software	Separate user's guide and online help for that software

Software Characteristics

Whether you have the HP E1741A Time Interval Analyzer software or the TIA User Interface software, your software provides the following measurement and analysis features:

- Graphical user interface implemented in Windows

  A mouse, or similar pointing device, can be used to set up the TIA, control operation, and analyze results.

- Up to 512K time records for the capture of an entire track of data

  Over 500 thousand data-to-data measurements can be acquired in sequence.

- Large histogram capacity

  Large amounts of data can be collected into a histogram very quickly. Window margin results can be produced from the histogram data.

- 80 MHz sample rate

  Every edge can be timed in a pulse series up to an 80 MHz rate (12.5 ns minimum continuous interval).

- Easily share data with other applications

  Export your time interval analysis results and graphs to other applications via the Clipboard. Typical applications include word processing, spread sheets, and advanced math analysis packages.

- 50 ps LSD

  Characterize small amounts of jitter and timing noise on a single-shot basis.

Option 002 HP E1725C TIA Hardware Configuration

An Option 002 hardware configuration is available. It replaces the standard 6-slot VXI cardcage with an HP E1401B 13-slot VXI cardcage.

Documentation List

The following manuals are part of the standard HP E1725C Time Interval Analyzer:

Manual Title	**HP Part Number**
HP E1725C/E1741A Time Interval Analyzer Getting Started Guide (this guide)	E1725-90011
HP E1740A Time Interval Analyzer User's Guide	E1740-90005
HP E1421B VXI Mainframe Manual	E1421-90000
HP E1406A Command Module User's Guide	E1406-90004
HP E1406A Command Module Installation Guide	E1406-90027
HP Omnibook 5700 CTX Laptop Computer manuals	_____
National Instruments GPIB User's Manual	_____
HP E1747A Timing Pattern Analysis User's Guide	E1725-90013
If you purchased any other software, documentation will be included.	_____
MS-DOS and Windows manuals	_____

Where to Find Information

The order in which you use these manuals will depend on your situation. When first starting to use the HP E1725C TIA or HP E1741A, refer to this Getting Started Guide. When setting up the HP E1740A TIA in a VXI system you will find important information in the HP E1740A User's Guide.

To find out more about...	**Refer to the following manual...**
installing the HP E1725C TIA	HP E1725C/E1741A Getting Started Guide (this guide)
installing the HP E1740A Time Interval Analyzer VXI module	HP E1740A User's Guide
the specifications for the HP E1725C/HP E1740A TIA	HP E1740A User's Guide
how to program the HP E1740A Time Interval Analyzer VXI module	HP E1740A User's Guide
the HP E1421B six-slot mainframe	HP E1421B Mainframe Manual
the portable computer for the HP E1725C	HP Omnibook 5700 CTX Laptop Computer manuals

1

How to Begin

In this Chapter

This chapter describes how to assemble and start operating your Hewlett-Packard E1725C TIA (Time Interval Analyzer). Although the steps provided in this chapter are written so you can put a TIA together from a completely disassembled state, the steps make a good checklist to follow when you suspect a problem with your setup.

Components Needed to Configure a TIA	**Components Provided with the Standard HP E1725C TIA**	**Possible Alternatives**
VXI mainframe	6-slot mainframe (included)	13-slot mainframe, e.g., HP E1401B
Computer	HP Omnibook 5700 CTX Laptop Computer	HP Vectra or IBM-compatible PC with HP 82335B or HP 82341B HP-IB card installed
VXI interface/control	Included in HP 1406A Slot-0 command module (with HP-IB card in computer)	____
TIA module	HP E1740A (included)	None
Measurement control software and histogram analysis software	HP E1741A Time Interval Analyzer software or TIA User Interface software	Create custom programs to control the module.
Specialized analysis software	Specific to your TIA configuration (see this chapter).	Create custom programs to control the module.
MS-DOS 6.0 (or later)	(included)	MS-DOS 5.0 (or later)
Windows® 3.1 or Windows® 95	Windows® 95	____
National Instruments PCMCIA-GPIB Kit	(included)	None

Assembling the TIA

HP E1725C TIA Assembly

This section assumes that the HP E1725C TIA is completely disassembled. Just skip the steps that do not apply to your situation. The intention is to meet your needs if in the future you need to rebuild an HP E1725C TIA that has been disassembled. **The standard HP E1725C TIA is shipped from the factory assembled and configured**.

1 Before you start, make sure power is shut off to all of the components.

2 Install the HP E1406A Command Module in slot 0 of the VXI mainframe. (With the standard HP E1725C 6-slot mainframe, this will be the slot at the bottom or left side, depending on the orientation of the mainframe.)

Line up the module with the slot guides and then press the module firmly into the backplane connectors. Tighten the screws attached to the command module to fully seat the module into the backplane connectors of the mainframe.

3 Install the HP E1740A TIA module in slots 1 and 2 of the VXI mainframe or any other open slots.

NOTE Always check that the mainframe power is OFF before installing any boards or instruments into the backplane connectors.

Line up the module with the slot guides and then press the module firmly into the backplane connectors. Use the screws attached to the module to securely tighten down the module.

4 Install blank panels over any unused slots of the VXI mainframe to help maintain proper cooling of VXI modules.

5 Install the National Instruments PCMCIA-GPIB Interface Card into a PCMCIA slot of the HP Omnibook Portable Computer. Follow the instructions provided with the interface card to install the drivers associated with the interface.

6 Connect the National Instruments PCMCIA-GPIB interface cable between the PCMCIA-GPIB card and the connector on the command module.

7 Apply power to the computer and the VXI mainframe.

Installing the HP E1741A Time Interval Analyzer or TIA User Interface Software

If you are unsure of the type of software you have, check the label on the disks. If you have either the HP E1741A Time Interval Analyzer, TIA User Interface, or HP E1747A Timing Pattern Analysis software, then follow these instructions to install the software. For any other software, refer to the installation instructions provided in other documentation.

Computer Requirements

The following are the minimum requirements to support operation of the HP E1741A or TIA User Interface software. The standard HP E1725C, which includes a portable computer, meets or exceeds all of these minimums:

- 20 MHz 386-based PC with a 387 co-processor
- 8 megabytes of RAM
- A hard disk with at least 5 megabytes of free disk space
- DOS version 5.0 (or later) and Microsoft Windows® version 3.1 (or Windows® 95)
- A two-button mouse

Install the Software

1 Insert disk 1 into the 3.5-inch floppy drive.

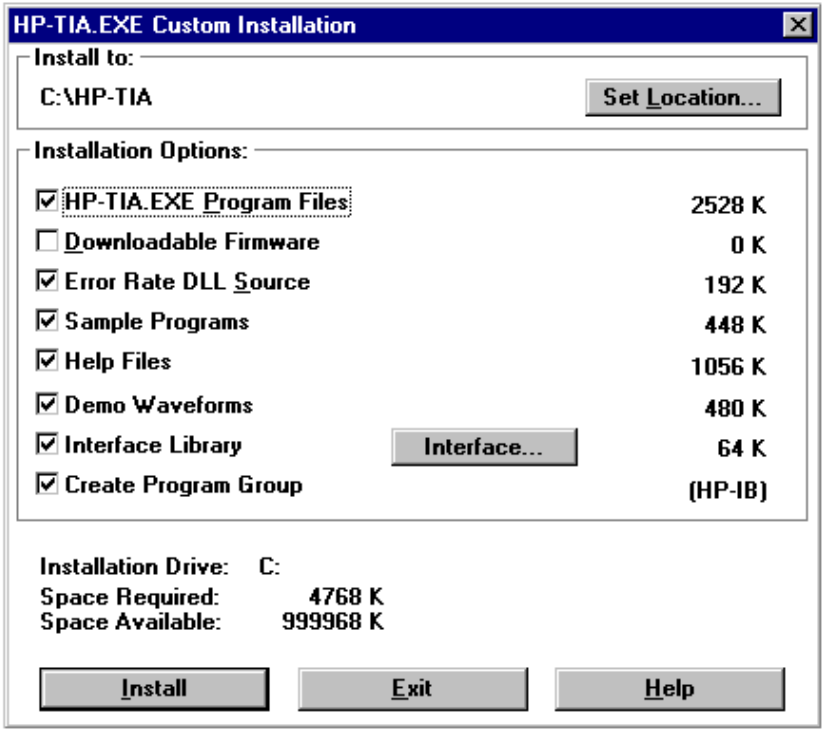
2 Start Windows 95, and select Programs group.

3 Double-click on the Windows Explorer icon, then choose drive **a:**.

4 Double-click on the Setup file to install the software.

The following window is displayed, which allows you to customize your installation.

Installation Choices



Set Location... Button

*The default is **C:\HP-TIA**. If you want to install the TIA files into a different directory, click the **Set Location** button and specify the preferred location. Click the **Continue** button to enter the new location and return to the installation window. Your selected installation directory now appears under "Install to:".*

HP-TIA.EXE Program Files

These are the files necessary to support the user interface.

Downloadable Firmware

This is the firmware that controls the HP E1740A. This file can be downloaded by the HP E1741A or TIA User Interface software into the HP E1740A TIA. Normally, you will not need to use this file because it is already loaded into the HP E1740A. Instances where the file may be needed would be if the HP E1740A's firmware became corrupted somehow, or an updated version of the firmware were supplied and needed to be downloaded to replace the current firmware. The default is not selected.

Error Rate DLL Source

Install this option if you might want to modify the standard extrapolation method used for window margin analysis. The standard method assumes the noise process (jitter) being analyzed is Gaussian. The online help describes the procedure for modifying the extrapolation function. The topic is Window Margin User-Defined Extrapolation.

Sample Programs

These sample programs can serve as examples for some useful tasks. One program moves measurement data from the HP E1740A to the controller, bypassing the HP E1741A interface software. Another provides a routine for moving data from the HP E1741A to an Excel spreadsheet file.

Help Files

Selection of this option will load the online help. You are strongly encouraged to install the online help. It contains a great deal of operating information, example tutorials, menu descriptions, glossary of terms, etc., that will enhance your understanding of how to use the TIA.

NOTE The help file contains information not available elsewhere. It is recommended that you include the help file in your initial installation.

Demo Waveforms

These demo waveforms were acquired from actual disk drives and can be recalled into the TIA. Additionally, the TIA setup used to acquire the waveforms is recalled as well. This is a handy way to demonstrate how the TIA would need to be set to acquire the data

displayed. Refer to Chapter 4 of this guide for procedures to analyze these waveforms. There are examples for the following measurements:

- *data-to-data*
- *data-to-clock*
- *PLL settling time*

NOTE You MUST install these waveforms to perform the exercises in this guide.

Interface Library

Select this option to load the file needed for the interface option you will select in the next step.

Interface... Button

*Click the **Interface** button and select the interface you will use. The choices include HP-IB, the Radisys embedded, the National MXI, the National GP-IB and None. Click the **Continue** button to enter the selected interface and return to the installation window. Your selection will be shown one line below and to the right of the Interface button.*

Create Program Group

This option will setup a new program group called Disk Test and place an icon for this software in that group.

If you de-select this option, no program group is created. After installation, you can place the executable program (hp-tia.exe) in any program group you want, using the selections under File menu in the Windows Program Manager.

Install the Software

1 Click the **Install** button, or press **ENTER**.

A progress meter will be displayed showing the percent of the program installed. You will be prompted to insert the second disk, if necessary.

2 When the installation is complete, click the **OK** button, or press **ENTER**.

NOTE

Be sure to send in your registration card. This will ensure that you are notified about software updates and other important product information.

Start the Application Software

1 If you left the **Create** Program Group choice selected during installation, bring up the **Disk Test** Program Group if it isn't already displayed. One way to do this is from the "Window" menu in the Program Manager.

If you didn't select **Create** Program Group during installation, you can run the application by selecting **File>Run**... from the Program Manager and setting the command line to **hp-tia.exe** in the directory where you installed it.

2 Double-click the **View Readme** icon to see special information about the TIA. This file contains information that was not able to be included in the printed documentation.

3 Double-click the **HP-TIA** icon to start the software.

Power-Up and Health Check

Start

1 Switch on the VXI mainframe before the computer.

2 Switch on the computer.

Start the HP TIA Software

1 Double-click the **Disk Test** Program Group icon in Windows to open the group.

2 Double-click the **HP-TIA** icon to start the application.

Set the Interface Type

If this is the first time you have started the software, or if no interface has been previously selected, you will be reminded to select the interface now. Click **OK** and continue with step 2. Otherwise, select the interface with the following steps:

1 Select **Control>E1740 interface...** .

The HP E1740A Interface setup window will appear.

2 Select the appropriate interface and addressing. Refer to the on-line Help under the topic of "Interface" and the corresponding documentation that came with the interface. Refer to the HP E1740A User's Guide for details on address switch settings.

3 Click on **OK** once the setting is chosen.

Set the TIA to Collect Actual Data

Select **File>Use live data**.

The synthetic data selection is used for demonstration purposes, as described in Chapter 3. Remember to perform this step when you want to start making measurements with the TIA.

Send Request for Identification

A convenient way to test the interface with the TIA is to send a request for the TIA to identify itself. Once you have started the TIA software, select **Control>Service>SCPI Control of E1740A**.

1 Enter the following command in the Send box: ***IDN?**

2 Press Enter key or click on the Send button.

The E1740A should return the following ASCII response:

HEWLETT-PACKARD,E1740,0,xxxx

- **HEWLETT-PACKARD** is the manufacturer.
- **E1740A** is the model number of the VXI TIA.
- **0** is always returned.
- **xxxx** is the HP E1740A firmware version.

Where to Go Now

Chapter 2 describes the online help system available to assist you in learning about and using the TIA software.

If this is your first time using the software, you may want to follow the short tutorial in Chapter 3. It demonstrates how to set up the HP E1725C TIA to acquire and analyze measurement data without the need for an actual signal to measure.

Chapter 4 is primarily for those TIAs equipped with HP E1741A analysis software and goes into more detail about measuring and analyzing signals from disk drives. Stored waveforms are used for these examples.

2

Learning About the On-line Help

In this Chapter

This chapter describes how to use the online help information that comes with the software.

Using Online Help

Extensive online help information about the operation of the TIA User Interface software is available as part of the application. There are two ways to access this information:

1 Press the F1 key when you want to know about a command or the window where you are currently working. The help information that appears will be based on the highlighted command or the currently active window.

2 Go to the Help pull-down menu and select one of the options. You can select from the following list:

Help Contents

A help window opens and displays a table of contents for the help information. Select from introductory, task, and problem solving topics.

Active Window F1

Help information for the active window is displayed. This selection is equivalent to pressing the F1 key.

Menu Commands

A help window opens and displays a list of the menus. Click on the menu of interest.

Reference

Presents overview information such as how the TIA interface is organized and other material on diagnostics.

Glossary

A help window opens and displays an alphabetical listing of the terms used in the Time Interval Analyzer.

Getting Started

Use this help information when first starting to use the TIA or as a reminder of the setup steps to follow when acquiring and analyzing data.

Common Tasks

Select from a list of frequently performed tasks. The steps to accomplish the task are described.

Common Problems

Select from a list of possible problems that might occur.

Using Help

Learn about using Help in Windows.

About the TIA

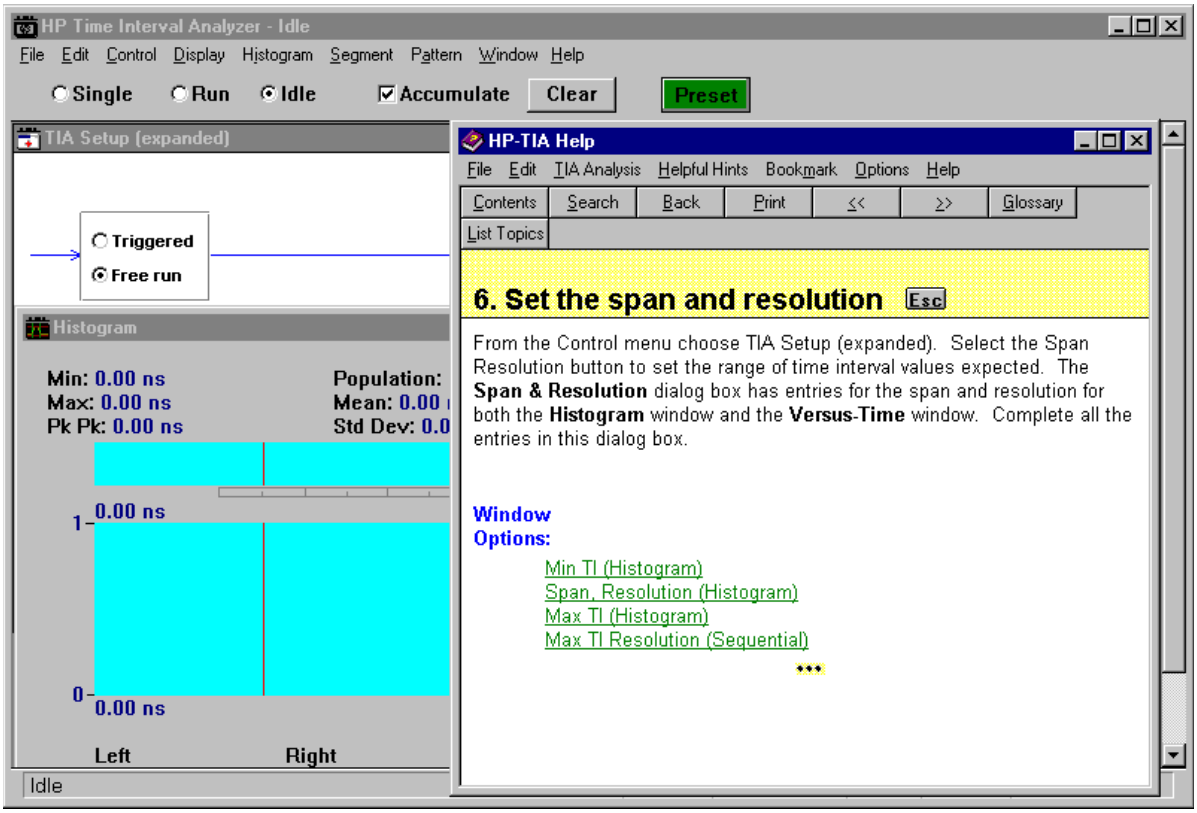
Displays the version of the software you are using, along with installed options.

Once you have opened the help window, you can navigate through online help using the help menu buttons and help menus:

- **Contents**—Help contents for the TIA.
- **Search**—Lists all the words you can use to search for help topics.
- **Back**—Displays the last topic you viewed, one topic at a time backwards in the order you viewed the topics.
- **History**—Displays up to the last forty topics you have viewed in the Help Window session.
- <<—Displays the previous topic in a series of related topics, until you reach the first topic in the series. The button is then dimmed.
- >>—Displays the next topic in a series of related topics, until you reach the last topic in the series. The button is then dimmed.
- **Glossary**—Displays an alphabetical listing of TIA terms.
- **List Topics**—Displays a listing of all software help topics in a secondary window. Click on a topic to view in the main help window.
- **TIA Analysis Menu**—Provides the means for easy navigation to an Analysis Topic.
- **Helpful Hints Menu**—Provides the means for easy navigation to a Helpful Hint Topic.

Suggested Help Screen Size

As with any window, the help window can be set to cover the entire display or a portion of it. Once you have the help window open, try adjusting its size so you can see the window where you are working at the same time. Just grab a corner or side of the help window using the mouse and size the window appropriately. See the example below.


HP Time Interval Analyzer - Idle
File Edit Control Display Histogram Segment Pattern Window Help
Single Run Idle Accumulate Clear Preset
TIA Setup (expanded)
Triggered
Free run
Histogram
Min: 0.00 ns
Max: 0.00 ns
Pk Pk: 0.00 ns
Population:
Mean: 0.00
Std Dev: 0.0
1
0.00 ns
0
0.00 ns
Left
Right
Idle
HP-TIA Help
File Edit TIA Analysis Helpful Hints Bookmark Options Help
Contents Search Back Print << >> Glossary
List Topics
6. Set the span and resolution
Esc
From the Control menu choose TIA Setup (expanded). Select the Span Resolution button to set the range of time interval values expected. The Span & Resolution dialog box has entries for the span and resolution for both the Histogram window and the Versus-Time window. Complete all the entries in this dialog box.
Window Options:
Min TI (Histogram)
Span, Resolution (Histogram)
Max TI (Histogram)
Max TI Resolution (Sequential)

You may also find it useful to always keep the Help window "on top" of the other windows on the display. This is done by selecting **Options>Keep Help on Top>On Top** from within the HP-TIA Help window.

3

Practice Using the TIA Software

In this Chapter

This chapter provides the opportunity for you to learn about some of the TIA software's features and operation without the need for connecting actual signals to the HP E1725C TIA. This synthetic data (data that is produced by the TIA software for demonstration purposes) is used for this tutorial to emulate what could be collected from an RLL (1,7) disk drive. This chapter describes how you would first set the TIA User Interface software to capture this data and then the steps you could follow to analyze this collected data.

NOTE

Some tutorial steps and descriptions in this chapter are specific to the HP E1741A Time Interval Analyzer software and are not available with the TIA User Interface software. (Check your disk label to see which type of software you have.)

The following items are demonstrated in this chapter:

- Selecting the Preset mode
- Use of Synthetic Data
- Purpose of TIA Setup window
- Introduction to Span & Resolution settings
- Use of the Fast Histogram mode
- Introduction to Histogram analysis
- Introduction to Segmented-Histogram, and Window Margin analysis. (Applies to the HP E1741A and HP E1747A software.)
- Use of the Sequential mode

Conventions Used in the Tutorial

Selecting Commands with the Mouse

You select commands by pointing with the mouse cursor and then clicking on each of the commands by pressing the left mouse button. For example, when you see, “Select **Control>TIA Setup [expanded]**”, click on the **Control** menu and then the **TIA Setup [expanded]** selection in the pulldown menu.

Hints Provided in Italics

Helpful information is presented throughout this tutorial. The information will help you with the current task or sometimes it is just to let you know that you are progressing properly.

TIA Software Tutorial

You should already have the software running. Refer to Chapter 1 of this guide for information on how to install the software and start the TIA application.

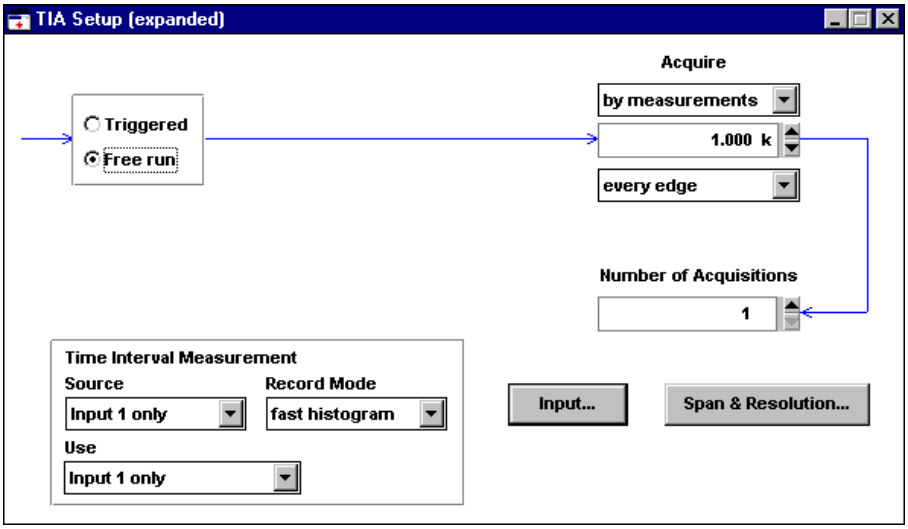
Start

1 Once the application is started, click the green **Preset** button to set the TIA User Interface software to its default conditions.

2 Select **File>Use Synthetic data**.

You will be using data that the TIA software will generate for demonstration purposes. This is a convenient way to experiment with the measurement and analysis features without the need for input signals.

3 Select the TIA Setup window by clicking on its title bar or selecting **Control>TIA Setup [expanded]**.



This window is used to specify how the TIA will acquire measurement data. As specified on this setup form, you will make a fast histogram acquisition consisting of 1,000 measurements. They will be single-source measurements as would be used when making data-to-data measurements and these measurements will be used for display and analysis.

The TIA Setup parameters are described below:

Free run

This selection indicates that the TIA will not wait for an external trigger once an input signal is present and the TIA is instructed to start acquiring data.

by measurements

This indicates that the amount of data collected will be based on the selected number of measurements, in this case 1,000.

every edge

This means that the TIA will attempt to acquire every edge of the input signal that meets the conditions described on the ***Input****... form.*

Number of Acquisitions

When set to 1 indicates that only one group of 1,000 measurements will be acquired with each display update.

Source

This setting (on the "Time Interval Measurement" panel) indicates that the input source will be the signal connected to Input 1 of the HP E1740A.

Use

This setting indicates how the acquired data will be processed for display and analysis. For this example, "Use" is set to "Input 1 Only" meaning the input 1 time intervals will be displayed and analyzed.

The Use field provides the ability to view measurements with respect to a computed clock (when "record mode" is set to sequential). For more information, use the online help and search for "computed clock."

Record Mode

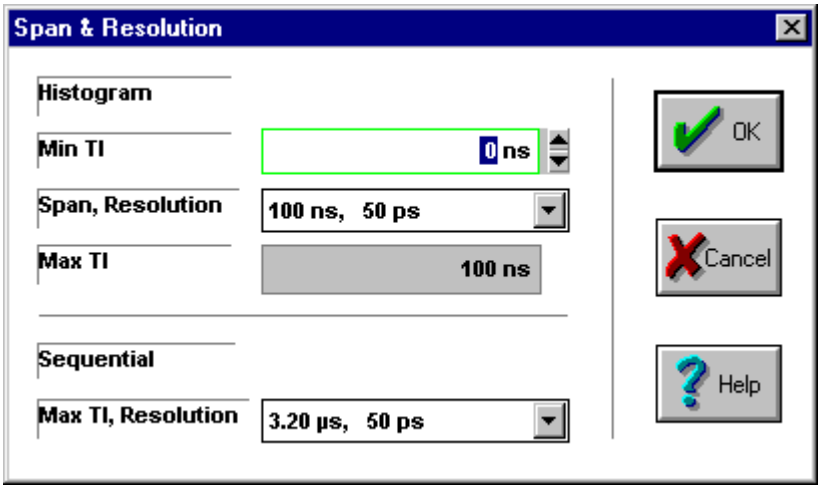
This indicates that the method used to record the data will be Fast histogram, meaning that the data will be routed directly to a hardware accelerator in the HP E1740A which histograms data on-the-fly.

NOTE

Remember: At any time, you can call up help information on the active window by pressing the **F1** key.

There is a button for Input on the setup window which calls up the settings for input signal conditioning. You will not use it for this tutorial, but you may want to go ahead and examine it at this point.

4 Click on the **Span & Resolution** button.



A dialog box is opened. There are two parts to this form, Histogram and Sequential. The upper part sets the boundaries for the histogram, the lower sets the boundaries for sequential measurements.

When the record mode (set on the TIA Setup form) is fast histogram, the settings in the Histogram portion of this form are of primary importance. When the record mode is sequential, there will be both sequential and histogram results (the HP E1741A derives histograms from the sequential data), so all the settings on this form have significance.

The two parts of this dialog box do interact with one another. For example, when you set a histogram span that exceeds the time interval range set under the Sequential portion of the form, the maximum TI range is changed to accommodate the span selected for the histogram.

5 To demonstrate this interaction perform the following steps:

a. Set the span to 6.4 µs and notice the change that takes place in the Sequential area of the form.

The maximum TI value is changed from 3.2 µs to 6.4 µs to reflect that the requested histogram span requires an increase in the maximum time interval range and includes a corresponding decrease in time interval resolution.

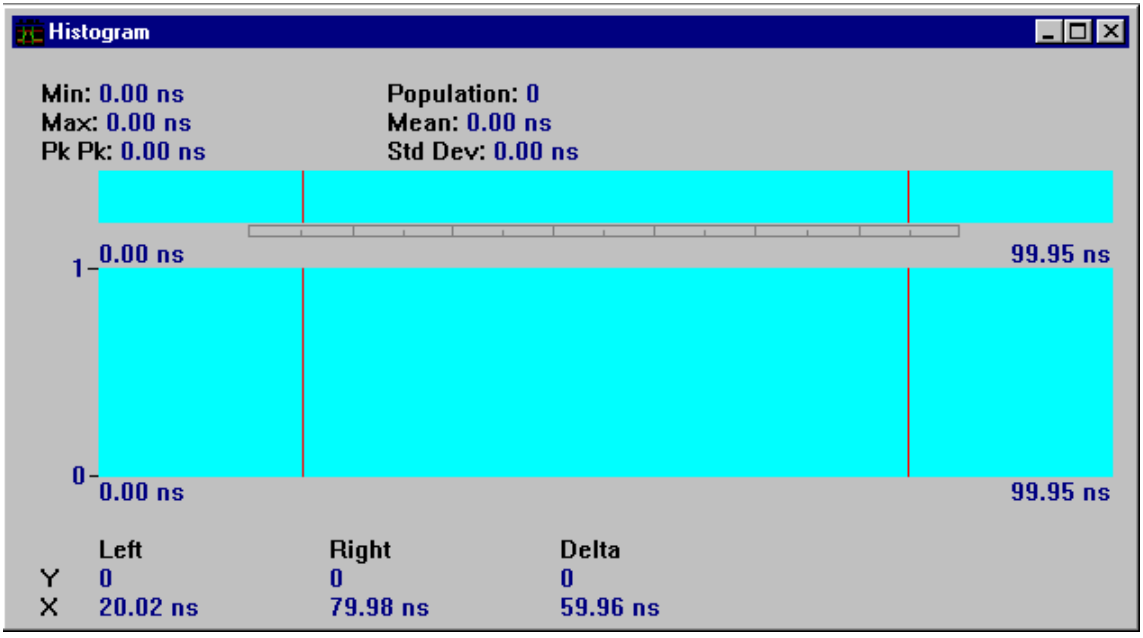
b. Click **Cancel** to leave the original settings unchanged and close the box.

Define Segments

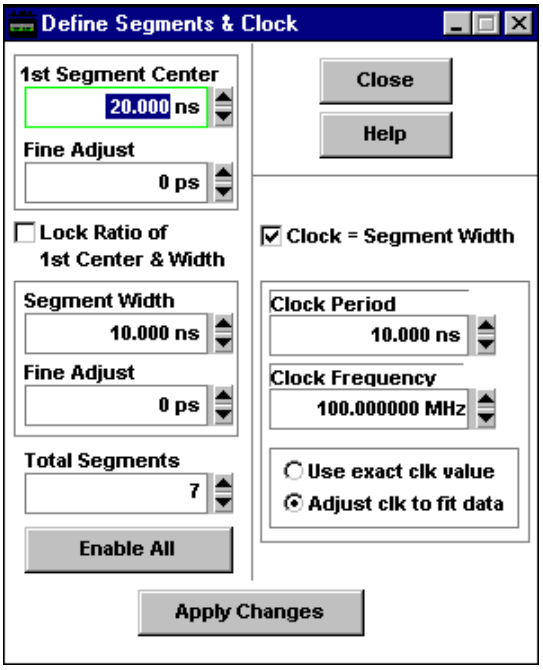
1 Select **Display>Histogram**.

The Histogram display appears. Note the connected boxes, visible below the upper display area. These boxes are called segments. They make it possible to define portions of the histogram span for selective analysis. (The segment definition is based on the characteristics of your measurement data, such as the expected code spacings.)

For the HP E1741A and HP E1747A analysis software only, once the data is acquired, the data for the individual segments can be individually added to, or subtracted from, segmented histogram and window margin analysis. (More about this later.)



2 Select **Segment>Define Segments & Clock**.



The dialog box that appears shows the current definition for the segments and clock.

Segment Definition

The segment window width is 10 ns and the first segment center is 20 ns. The number of different code spacings, or total possible “windows” to selectively analyze, is seven. They will start at 20 ns and be spaced 10 ns apart to 80 ns. The segment width corresponds to the decoding window width, usually the PLL clock period. The 1st segment center is the expected nominal value of the time interval associated with the shortest expected code spacing. You can use this box to define portions of the histogram data for segmented histogram and window margin analysis. This can be done before or after the data is acquired.

The Fine Adjust fields are useful for “fine tuning” the settings. When making data-to-data measurements you can experiment with making slight changes to the value of the decoding window or the center value of the first segment. This can be done while viewing the Segmented Histogram or Window Margin results. Improvements in the results may help determine, for example, an optimal offset to add to the drive's data decode window circuitry.

Clock Definition

The clock period is 10.000 ns and the segment width is set to equal the clock period.

NOTE

To cause value changes to take effect on the Define Segments & Clock window, click the **Apply** button.

3 Click the **Close** button to remove the **Define Segments & Clock** window, or click the **minimize** ( ) symbol in the upper-right corner of this window to miniaturize it.

Acquire Data

1 Click the **Run** button.

The TIA software starts acquiring data. Note that the Accumulate control, near the top of the application, is enabled. This means that the results from each acquisition will be accumulated with prior acquisitions. You can restart the accumulation process at any time by selecting the Clear button. If you wish only the last acquisition displayed, disable Accumulate.

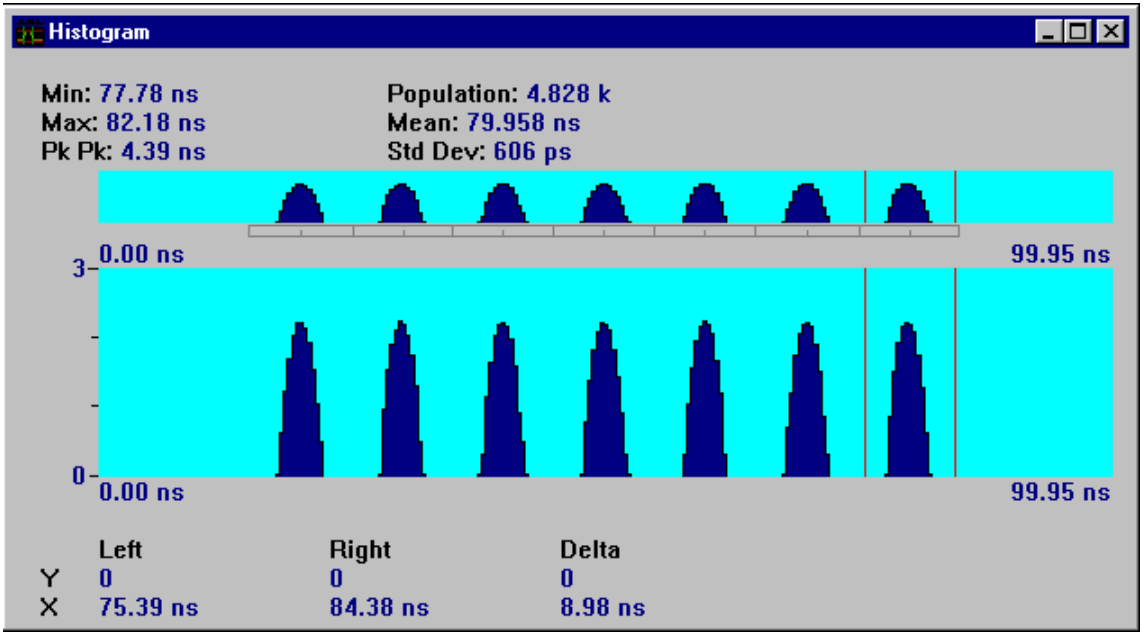
If you were acquiring actual data from the HP E1740A, the number of interval measurements from each acquisition would be exactly 1,000 (the selected value on the TIA Setup window). In the synthetic data mode, each update is approximately the requested size. The data produced is based on the segment definitions. You can see the histogram distributions take shape. Each of the seven distributions represents the measured intervals at a particular code spacing. The statistics displayed above the graph include all of the data between the markers.

2 Click the **Stop** button.

The TIA stops acquiring data and goes to the Idle condition.

Analyze the Histogram Data

1 Use the mouse to drag the markers. Adjust them so they delimit a single distribution. You can drag a marker from either the panorama or main display.



Now you can read the statistics for one distribution. The panorama display (the display just below the statistics) always shows the entire span of the histogram, while the main display below can be scaled to show a closer view of the data.

2 Press the **Up Arrow** key on the keyboard several times until a close-up of one distribution is visible.

You can make a fine adjustment of the display position with the left and right arrow keys. The portion being viewed in the main display is highlighted on the panorama display. You can also adjust the main display position by placing the mouse pointer over the highlighted panorama region, holding down the left mouse button and dragging the highlight region to the desired area. Markers can be manipulated in the panorama region.

You can perform this same action using the right mouse button, which has the added feature that any marker in the highlighted area will also be dragged along. You can access markers in either the main or panorama display.

This allows you to set the markers a specified distance apart and move them together—always getting statistics reported over a fixed spacing between the markers (such as the decode window of the disk drive under test).

NOTE

You can easily re-size the histogram display (and most other windows) as desired using the standard windows re-size techniques. In particular, to make the Histogram display full screen size, click the **maximize** ( )in the upper-right corner of the display.

Segmented Histogram Analysis (Applies to HP E1741A or HP E1747A Software Only)

1 Select **Display>Segmented-Histogram**.

2 Now use the online help to find a description of this data view. This view shows the data folded about its segment center and combined for one-sided results.

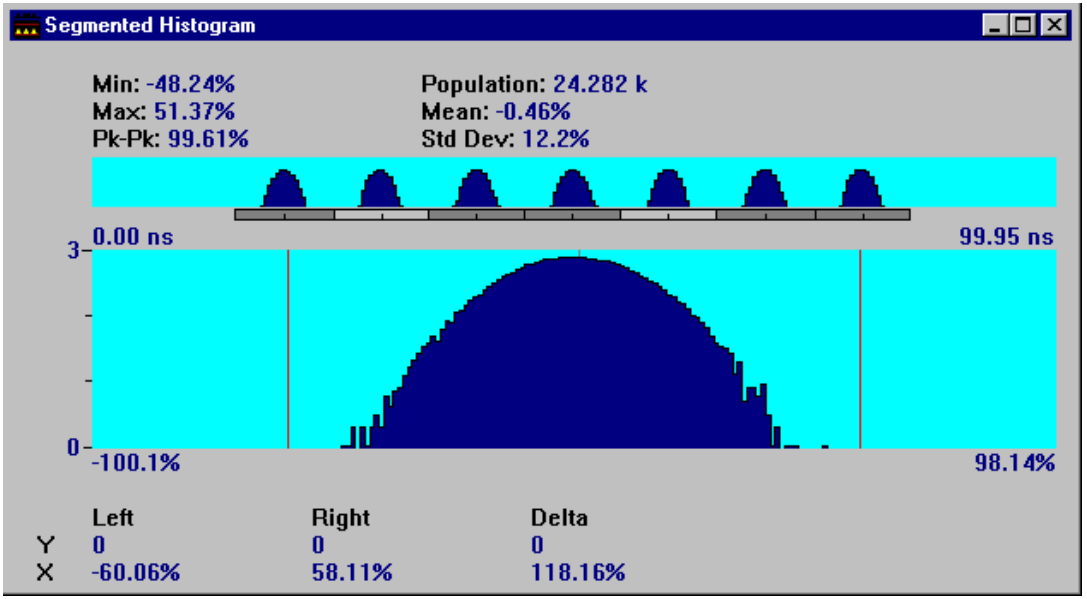
NOTE

Use **F1** to get to a description of the segmented histogram, then click on the green text, “Analyzing Segmented Histogram Data” under See Also, and then click on the related topic called “Combined segments”. Read the description of combined one-sided.

You can remove or add individual segments from the analysis (main display area) by clicking on the segment below the distribution. Move the mouse pointer over the segment and click the left mouse button to disable the selected segment. Try this for several segments. Clicking a second time replaces the distribution in the analysis.

3 Select **Segment>Two-sided**.

This disables the folding of the data about the segment centers, so now you see both early and late data. The vertical line in the center of the display is the window center. It has a time value of 0s.



4 Read the description of combined two-sided analysis on the help screen.

NOTE

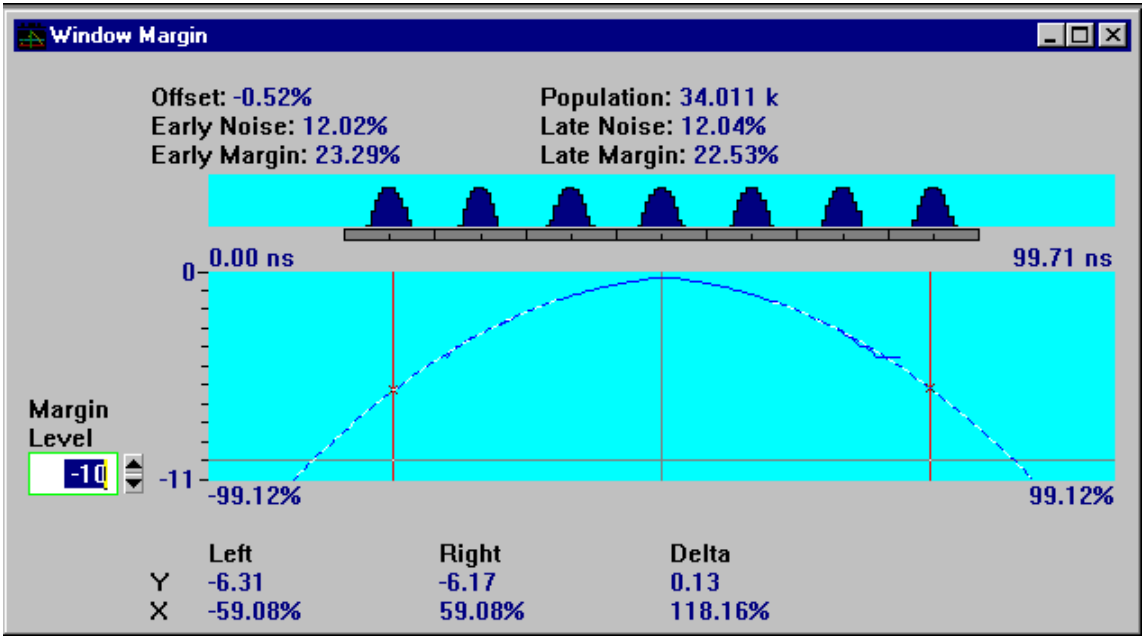
An easy way to go back to the help information is by holding down the **Alt** key while pressing the **Tab** key once, and then releasing the **Alt** key.

The shortcut above assumes the Help window has not been closed.

Window Margin Analysis (Applies to HP E1741A Software Only)

1 Select **Display>Window Margin**.

Now the window margin analysis of the acquired data is shown.



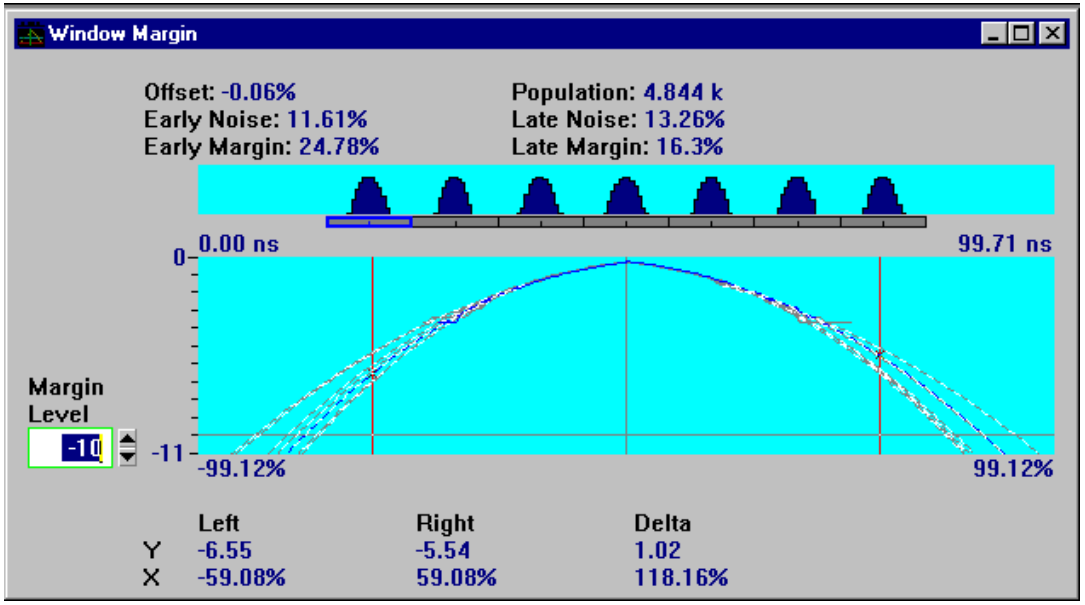
The statistics summarize the window margin results for all the enabled segments.

2 Select **Segment>Overlaid segments**.

The traces for each enabled segment are overlaid. The window margin results at the top and the marker results at the bottom are now stated only for the active segment (outlined in blue).

You can enable or disable segments with the left mouse button. Simply move the mouse pointer to the segment you want to change and click the mouse button. Dark gray segments are enabled, meaning that data from that segment will be included on the main display. Use the right button to activate (highlight) the segment to be analyzed in the main display.

3 Try activating different segments to find the one with the worst-case window margin results.



NOTE

The segment enable/disable and activate features also work when **Segment>Combined segments** is selected, or if a one-sided result has been chosen. Also, all the these features are available with the Segmented-Histogram display.

4 Select **WindowMargin>Show results**.

This is a tabular listing of window margin results for each enabled segment. This window also responds to changes in the combined/overlaid selection and one-sided/two-sided selection.

The data from this window can be copied to the clipboard using the **Edit>Copy** selection. Demo 4 in this guide illustrates this feature.

Sequential Data Analysis

All of the tasks so far have dealt with using histogram data. The software can also acquire data as measured value versus the time-of-occurrence. The Sequential record mode preserves the sequence of time interval measurements and the precise time of occurrence. This information is not available when using the fast histogram mode.

1 Select the TIA Setup window again.

2 Set the Record Mode to sequential.

3 Select **Display>Versus-Time**.

4 Click the **Run** button.

Data is now being stored into sequential memory. What you see on the Versus-Time display are the 1000 interval measurements displayed as a function of time.

5 Click on the **Stop** button.

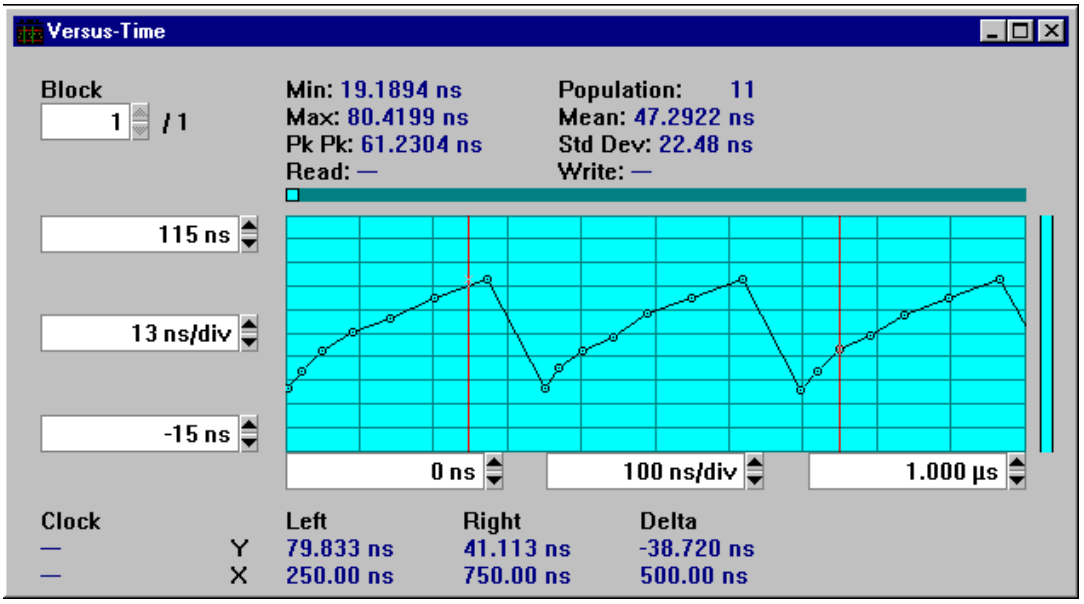
6 Set the **cursor** in the middle numeric entry field below the display (/div).

This field adjusts the horizontal zoom level.

7 Use the **Left Arrow** key to move the cursor in front of the first digit.

8 Use the **Down Arrow** key to reduce the time per division. Adjust the value to about 100 ns/div.

NOTE To learn more about the numeric controls, go to the online help topic "numeric entry." (Use the online help search feature to navigate there.)



You can see the time order of the measured time intervals. There is a repeating pattern of seven time intervals. Each one corresponds to a distribution you saw earlier in the histogram data. The y-axis shows the time interval values, between 19 and 80 ns. The x-axis shows the time-of-occurrence for each measured interval.

Markers are also available on this display. Simply drag the marker to the desired area with your mouse. Marker results are reported below the main display. Statistical results, based on the data between the markers, are reported above the main display.

When you zoom this display, the relationship of the portion of the data viewed to all acquired data is indicated in the narrow horizontal bar just above the main display.

Histogram results are also available in the Sequential record mode. Select the Histogram display to see the histogram of the sequential results.

This completes the TIA software tutorial practice session.

Where to Go Now

For tutorials to help you measure formatted or unformatted disk drives and perform timing pattern analysis, select the Help menu, Contents, and then Tutorials.

To learn about other software capabilities, go to Chapter 4, which uses stored waveforms. Examples of data-to-data, data-to-clock, and PLL settling time measurements are described.

4

Demo Waveforms

In this Chapter

This chapter provides demonstrations using data that was acquired from actual disk drives. The data was then saved using the **File>Save data** menu selection. You can use this same feature whenever you want to save data. You will be recalling this measurement data from files that were installed during the software installation process described in Chapter 1. These demonstrations do not require the HP E1740A Time Interval Analyzer measurement module.

Demo 1: Data-to-Data

This demonstration uses consecutive data-to-data intervals measured from a formatted hard disk drive with the HP E1725C with HP E1741A software. Time intervals were captured and sorted on-the-fly into a histogram using "fast histogram" hardware. The histogram data has been saved to disk and will be recalled for this demonstration. The histogram, statistics, and window margin analysis features of the HP E1741A will be demonstrated.

The drive used to gather this data uses RLL (1,7) coding and has a 15.6 ns decode window (T). A random data pattern was written in every sector on the track.

Start

1 Select **File>Use saved data**.

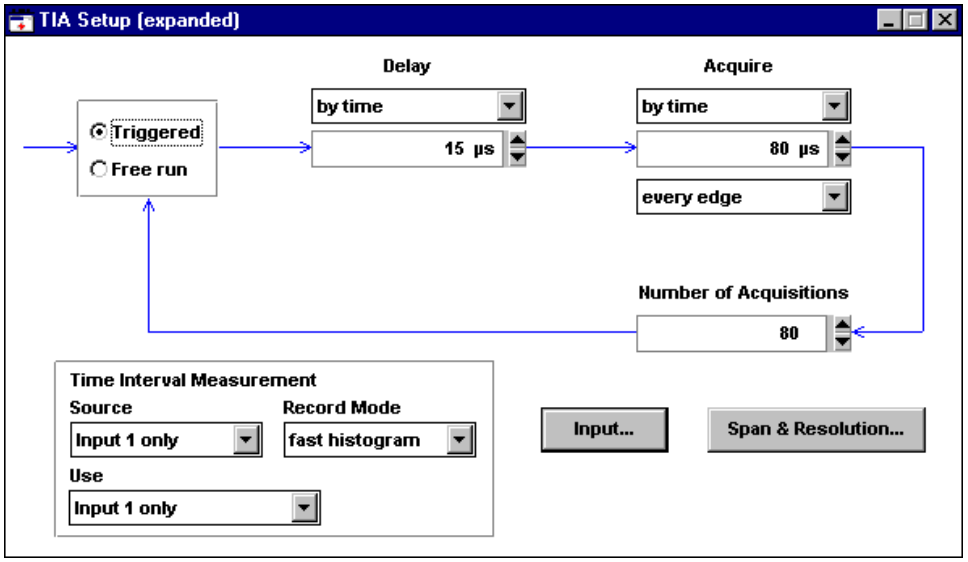
2 Open the demo subdirectory and click on the file "**d-to-d.tid**."

3 Click the **OK** button.

4 Select **Control>TIA Setup [expanded]**.

Overview

The drive under test is formatted, so a “start-of-sector” pulse is used to trigger the TIA once for each sector. The start-of-sector pulse occurs 15 µs prior to the beginning of the data portion of the sector. The data portion of the sector is 80 µs in duration. Eighty consecutive sectors were acquired.



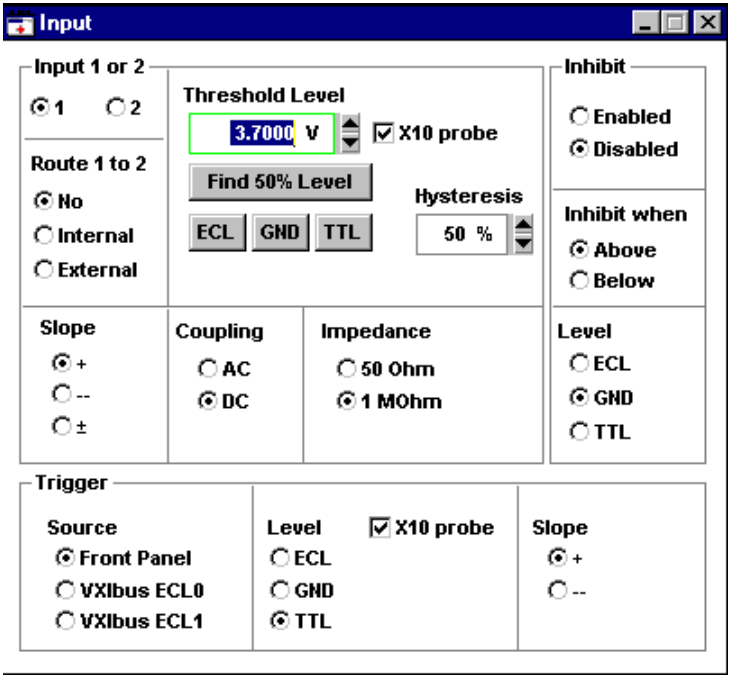
This is the TIA setup menu to make data-to-data measurements on the drive under test. The screen is configured as a flow diagram showing the various stages of the measurement. Reading from left-to-right you can see that the TIA will wait for a trigger, delay 15 µs and then measure every edge for 80 µs. This sequence is repeated 80 times, which results in the acquisition of 80 consecutive sectors.

1 Click on the selection boxes ( ) in the flow diagram to see the variety of possible triggering and acquisition selections.

NOTE

Whenever you save data, the setup information is automatically saved as well. When the data is later recalled, so is the setup. This allows you to see all of the conditions that were used when the data was originally acquired.

2 Click on the **Input** button to view the input configuration.



This screen configures the input circuitry on the HP E1725C TIA for the particular signals from the drive under test. The data signal (connected to input 1) has a 50% point at 3.7 volts, and a X10 probe is connected to the test point. Hysteresis, or sensitivity, is set to 50%.

NOTE

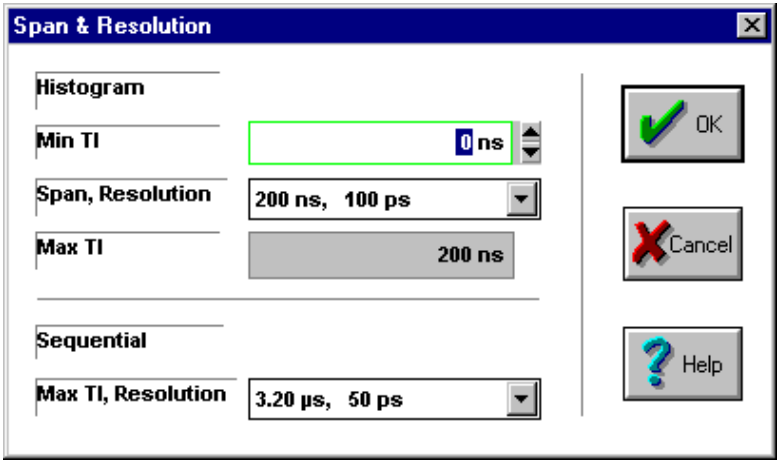
Input 1 also features +, –, and ± slope selections. The ± selection causes the TIA to measure all edges, regardless of slope. This is useful for optical disk drives where information is recorded on both signal edges.

If you were actually making a measurement and were unsure of the appropriate threshold level setting for Input 1 or Input 2, you could click "Find 50% Level" and the hardware would set the level based on the actual input. This level would appear in the "Threshold Level" box and the signal minimum and maximum values would be reported near the bottom of the "Threshold Level" panel.

Also, the trigger source is set to come from the front panel indicating that a trigger signal was provided at the front panel of the HP E1740A. The other trigger source choices allow the trigger to be received on the VXIbus.

3 Double-click on the box in the upper left corner of the Input window to close this window.

4 Click on the **Span & Resolution**... button.



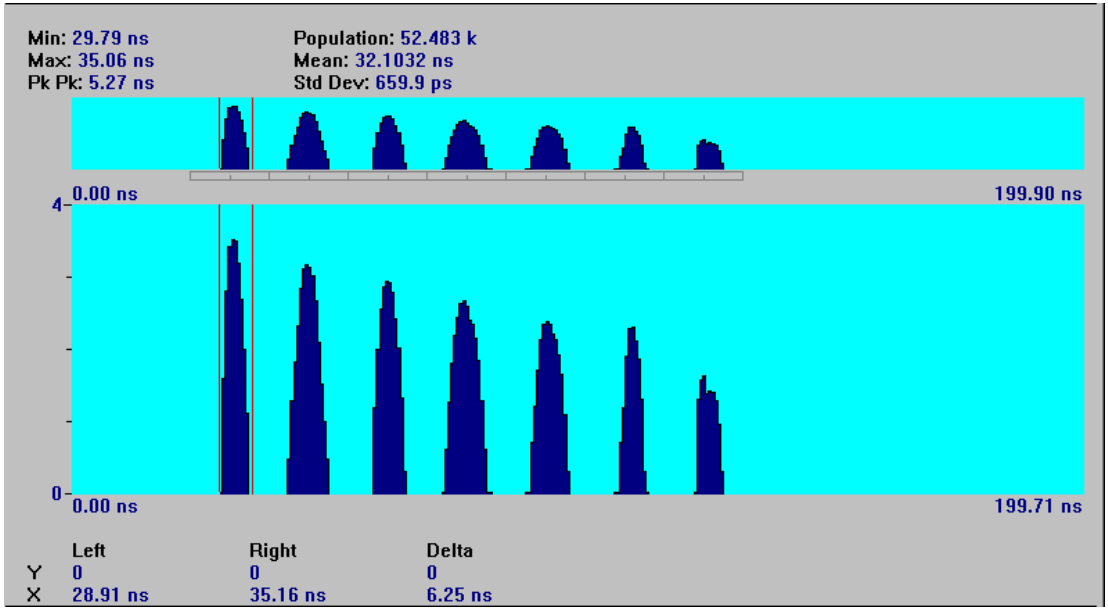
This window configures the fast histogram hardware to cover the range of intervals being measured. Since this drive has a decode window or "T" spacing of 15.6 ns and uses RLL (1,7) coding, intervals will cover the range from 2T to 8T (31.2 ns nominal to 124.8 ns nominal). A span of 200 ns is chosen to cover this measurement range for the histogram. The resulting histogram bin width, or resolution, is 100 ps.

5 Click on the **Cancel** button on the Span & Resolution window.

Histograms and Statistics

1 Select **Display>Histogram**.

2 Maximize this window by clicking on the **maximize** ( ) symbol in the upper right corner of the Histogram window.



This histogram result display clearly shows the seven time interval distributions corresponding to the 2T through 8T code spacings. The upper display is called the panorama display and always shows a full view of all the data acquired. You can “zoom-in” or magnify the data by pressing the ↑ key on the keyboard. The larger, main display will show the magnified view.

The highlighted box in the panorama display can be moved with the mouse by clicking on it with the left mouse button and moving the mouse while holding the left button down. In the same way, the two markers can be manipulated in either the panorama or the main display. Both markers, and the zoom view can be moved together by clicking and holding the right mouse button and dragging the box.

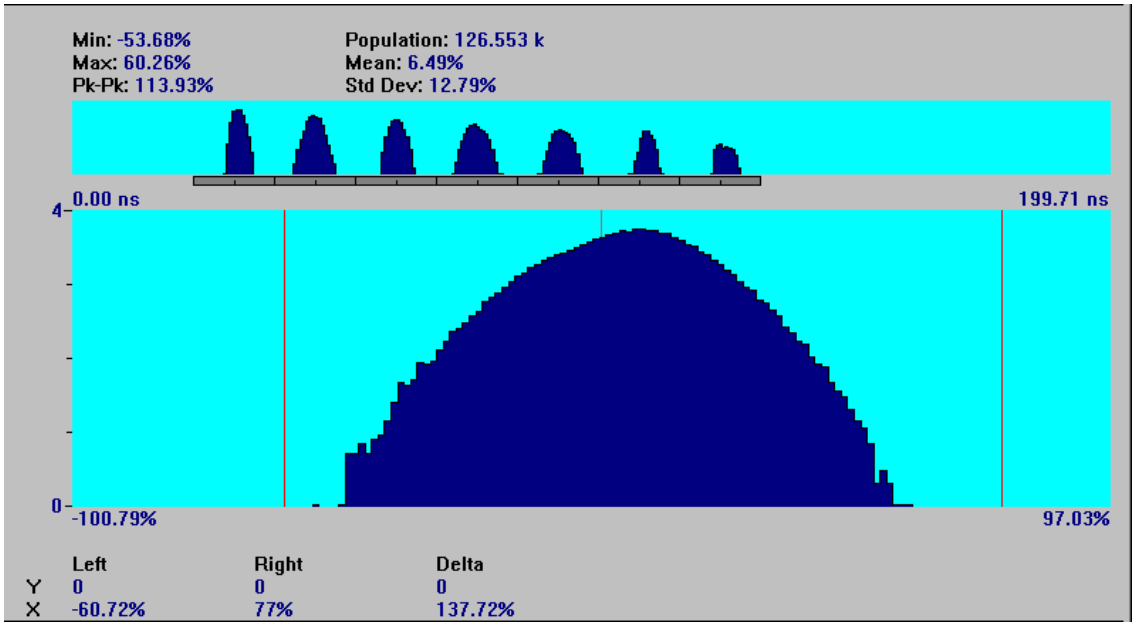
Notice that the top of the display always shows statistical information for the data between the current position of the markers. The bottom of the display shows the current position of the markers and the difference between these positions.

3 Press the **F1** key to see more details about the histogram.

4 Double-click on the box in the upper left corner of the Help window to close the window when you are finished.

Segmented Histogram

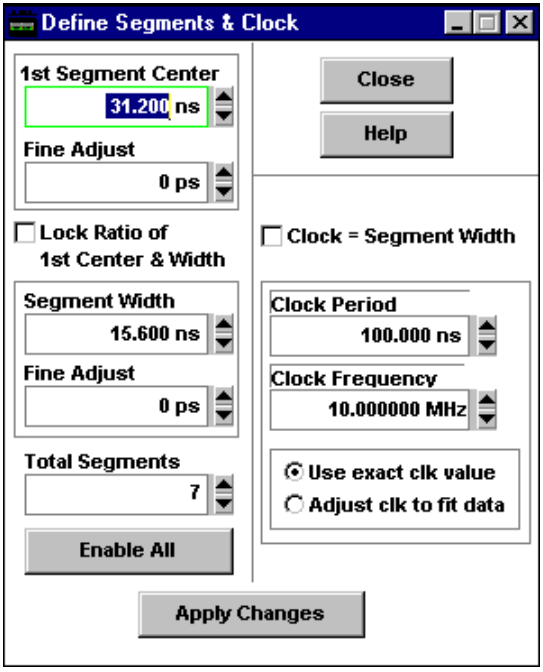
1 Select **Display>Segmented-Histogram**.



This result display allows you to analyze histograms by defined "segments" or decode windows. The panorama display shows the individual distributions as with the previous histogram display, but the main display shows the histograms combined, or added together based upon the segment definition. Notice the darkened grid beneath the panorama display. This represents the currently defined segments. The half tic mark represents the center of each segment.

The marker results and statistics are shown in percent of the half segment width where –100% represents the early segment (or decode window) boundary, 0% is the segment center, and 100% is the late segment boundary. To see these values expressed as time with respect to the segment center, select **Seg-Hist>Display results as time**.

2 Select **Segment>Define Segments & Clock**.



This window allows you to define the number and position of the segments and define the clock. Since this drive has a 15.6 ns decode window, the first distribution (2T) is located at 31.2 ns. The RLL (1,7) coding dictates that there should be 7 segments. These segment definitions are also used for window margin calculations. Since data-to-data intervals are used for display and analysis for this demonstration (instead of data-to-clock), the clock definition is not required.

3 Double-click on the upper left corner of this window to close the **Define Segments & Clock** window.

The main display of this Segmented Histogram window shows all of the segment data combined. All of the segment cells beneath the panorama are currently darkened. You can select the distributions you would like to include or exclude in the statistical analysis on the main display by clicking on the corresponding segments beneath the panorama display. If the segment is dark (grayed), it is selected. If it is light, it is excluded from the analysis.

Note that the mean value currently displayed is 506.4 ps (this is the difference between the center of the segment and the mean value of the combined distributions).

4 Click on the first segment (2T) to disable it.

Note how dramatically the mean value is changed when this distribution is excluded. (Observe the change in the distribution shape as you enable/disable this segment). Clearly, significant peak-shift is associated with the 2T segment data.

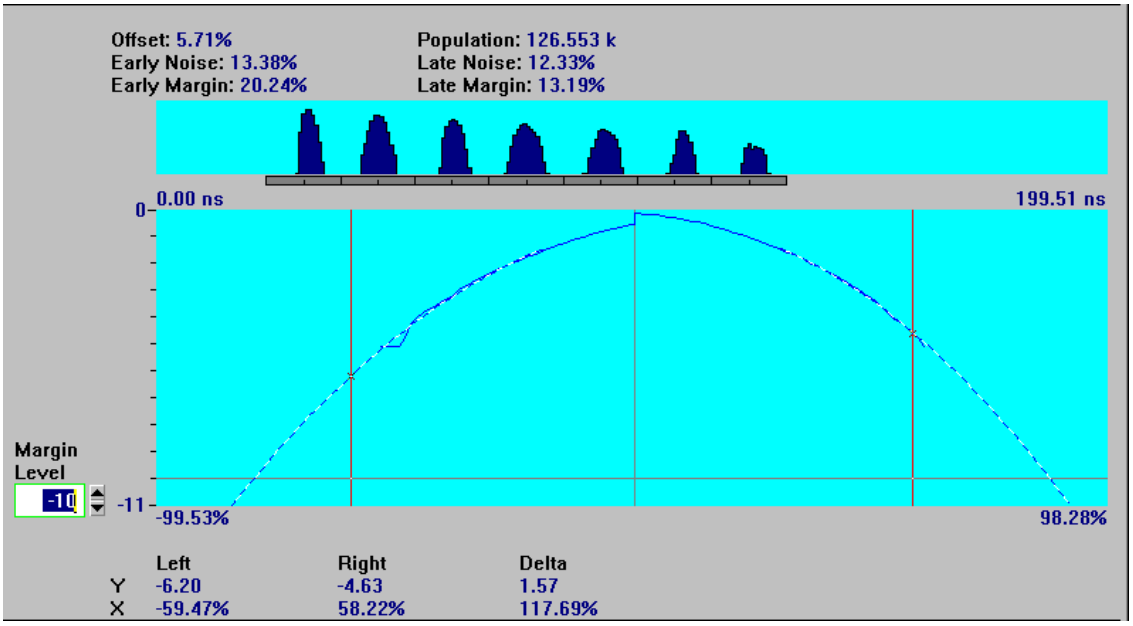
NOTE

You can also overlay segment results on this display. Select **Segment>Overlaid Segments**. Individual results from each enabled segment are displayed. Statistics are reported for the highlighted waveform which is associated with the highlighted (active) segment. To activate a different segment, point and click your right mouse button on the desired segment.

5 Click on the first segment again to enable it.

Window Margin Analysis

1 Select **Display>Window Margin**.



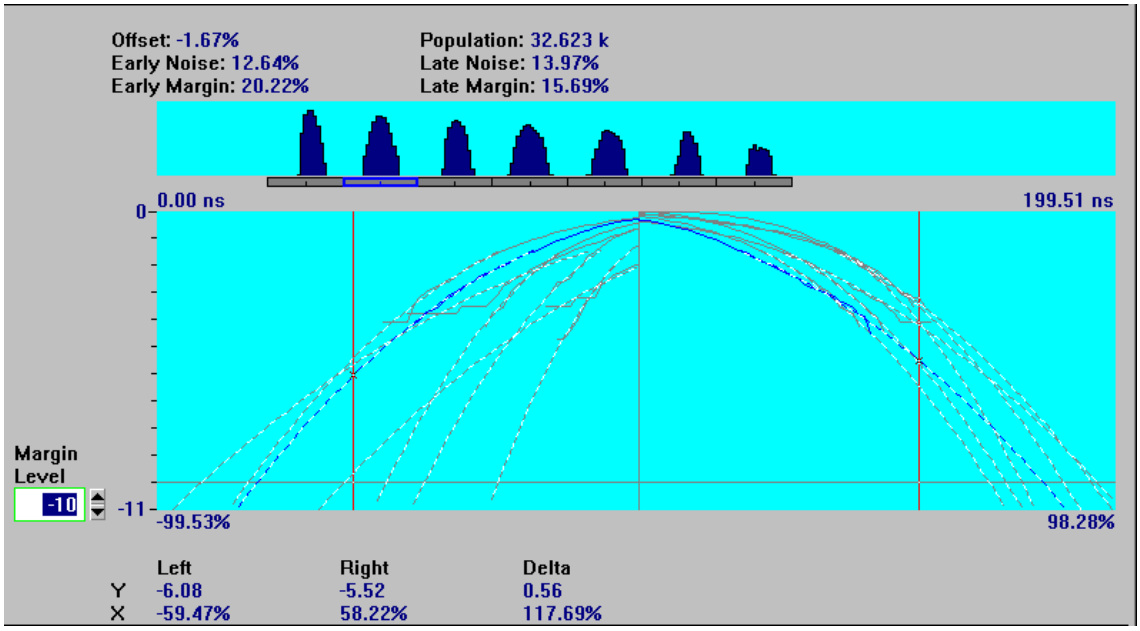
This display shows window margin computed from the histogram, using the segment definitions created earlier. The panorama display shows the original histogram distributions, and the main display shows the computed two-sided window margin. The dashed line is the extrapolated curve through 10^{-10} margin level.

In the same fashion as the segmented histogram screen, you can enable or disable segments to be included in the window margin analysis.

NOTE

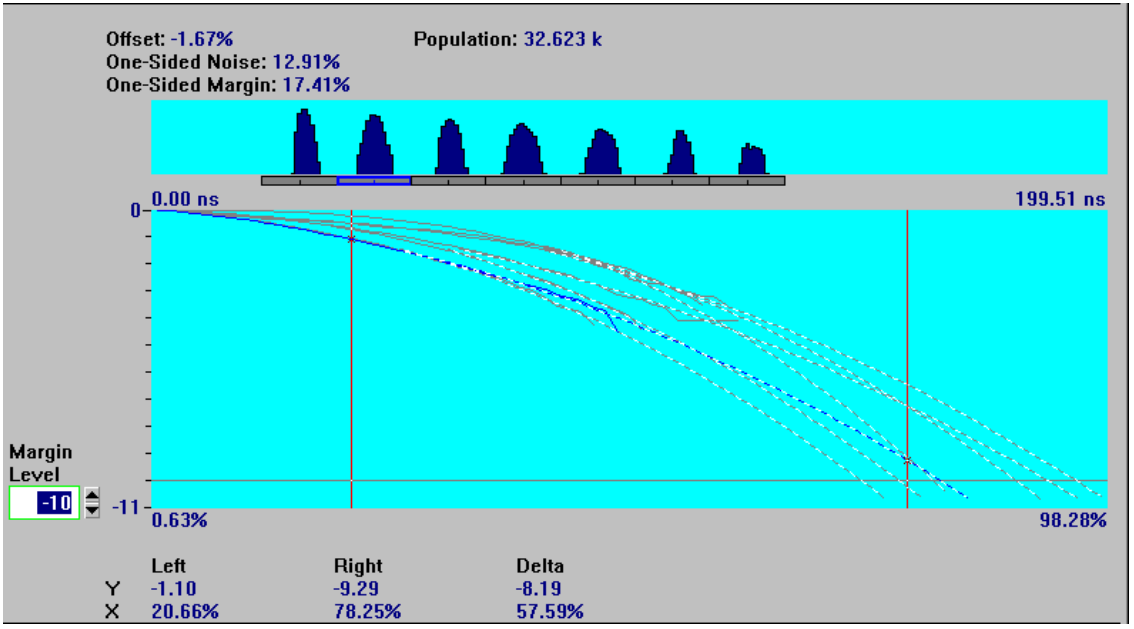
The Margin numbers displayed in the upper portion of the display are reported based on the Margin Level set. Therefore, as expected, the Margin will change as Margin Level is changed.

2 Select **Segment>Overlaid segments**.



This display now shows the window margin curves for the individual distributions overlaid, rather than combined. One segment beneath the histogram is highlighted (in blue). Its corresponding window margin curve is also highlighted in blue on the main display. The window margin results and the marker readouts correspond to this selected segment.

3 Select **Segment>One-sided**.



This display shows the one-sided window margin plot, with the segments overlaid. The one-side margin plot is computed by "folding" all of the distributions about the segment centers, adding the selected segments together, and computing window margin from this single-sided histogram.

4 Click on the 7T segment (second distribution from the right) with the **right** mouse button.

Note that the 7T segment has the worst margin of the various code spacings.

If you want to evaluate the margin at a different error rate, change the entry in the "Margin Level" box to the desired level. The level is always indicated at approximately one grid line from the bottom of the display.

To report results in time rather than % of the half-segment width, select **WindowMargin>Display results as time**.

5 Close all of the open windows by selecting **Window>Close All**.

This completes Demo 1.

Demo 2: Data-to-Clock

This demonstration uses data-to-clock intervals measured from a formatted hard disk drive with the HP E1725C TIA. Time intervals were captured and sorted on-the-fly into a histogram using "fast histogram" hardware. The histogram data has been saved and will be recalled for this demonstration. The histogram, statistics, and window margin analysis features of the HP E1741A will be demonstrated, as well as the ability to define which portions of the margin curve are used to extrapolate the margin curve.

The drive used to gather this data uses RLL (2,7) coding and has a 50 ns decode window (T). A random data pattern was written in every sector on the track.

Start

1 Select **File>Use saved data**.

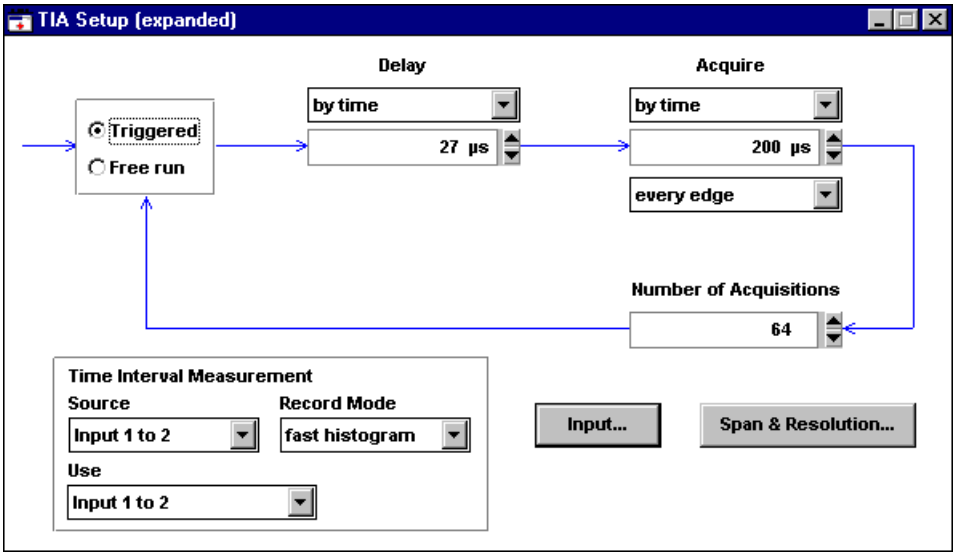
2 Open the demo subdirectory and click on the file "**d-to-c.tid**."

3 Click the **OK** button.

4 Select **Control>TIA Setup [expanded]**.

Overview

The drive is formatted so a “start-of-sector” pulse is used to trigger the TIA once for each sector. The start-of-sector pulse occurs 30 µs prior to the beginning of the data portion of the sector. The data portion of the sector is 200 µs in duration. There are 64 sectors around the track.



This is the TIA setup menu to make data-to-clock measurements on this formatted drive. Notice that this screen is similar to the data-to-data configuration used in demonstration 1. However, the time delay from the trigger, and the acquisition time has been modified as this data was captured from a different drive. Reading from left-to-right you can see that the TIA will wait for a trigger, delay 27 µs and then measure for 200 µs. This sequence is repeated 64 times to build a histogram. The acquisition contains 64 consecutive sectors of data-to-clock measurements.

Notice that the time delay from trigger was set too small (27 µs instead of 30 µs) and as a result, the TIA made a few measurements in the header (non-data) region. These “errant” measurements will be used later to further illustrate capabilities of the software.

Since this is a data-to-clock measurement, the “Source” is Input 1 to 2 to indicate an expected signal at Input 1 and Input 2 on the front panel of the HP E1740A. The “Use” selection is Input 1 to 2 to specify that Input 1 to 2 intervals are to be used for display and analysis. For record mode measurements of “fast histogram,” the “Source” and “Use” fields will be identical.

To see the input settings used for this measurement, click **Input**... near the bottom of the TIA Setup window.

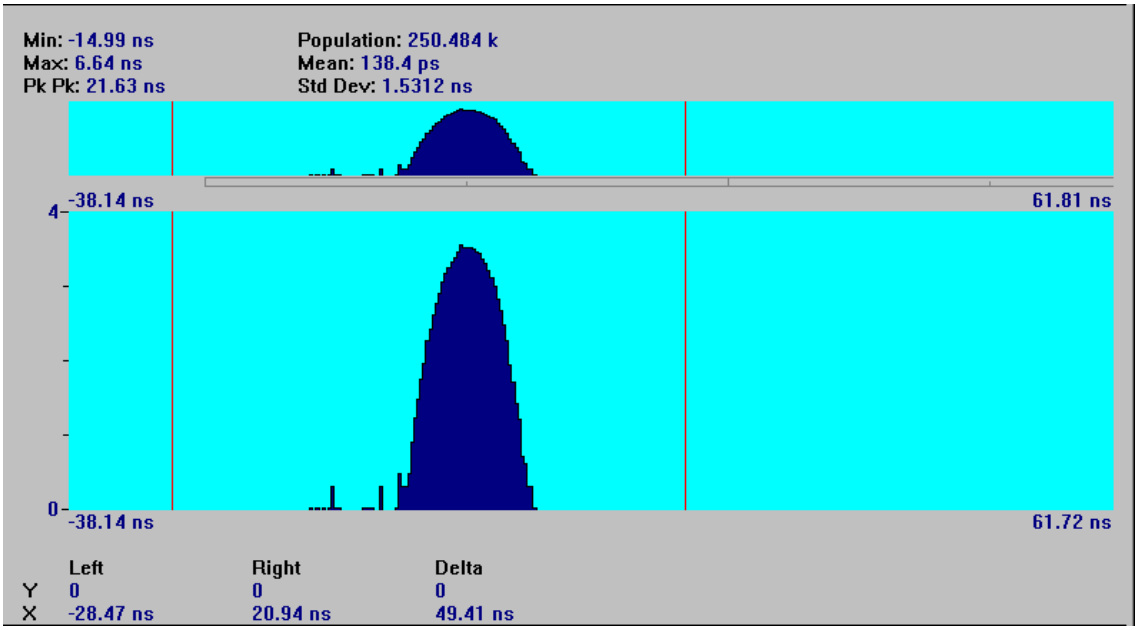
NOTE

The Input 2 settings can be viewed by selecting 2 on the “Input 1 or 2” panel.

Histograms and Statistics

1 Select **Display>Histogram**.

2 Maximize this window by clicking on the **maximize** ( ) symbol in the upper right corner of the Histogram window.



This histogram display shows a single histogram distribution, corresponding to the data-to-clock measurement configuration. With dual-channel measurements there are often systematic timing differences (skew) between the measured edges of each channel. This can occur for numerous reasons: cable length differences, propagation delays in circuit access points, etc. The TIA has been calibrated so that internal path length differences should not contribute significant timing skew.

3 Select **Control>Adjust Input 1 to 2 Reference**.

The software provides a way to remove systematic channel differences. The “Reference” value on this form identifies a number that is used to zero-out timing skew. This value is applied to Input 1 to 2 measurements. For this demo, the reference was set to 13.1 ns. The reference value is reported on the status bar (lower right corner) of the application. Note

that this value has the potential to create unexpected results for users who may not have realized a non-zero reference value was applied. Go to the online help topic “Nulling Timing Skew” for details on how to use the reference to null external timing skew.

For data-to-clock measurements, the ideal relationship between these signals is an average time difference of zero. Using the online help description, the needed reference value was determined to be 38.1 ns. Enter this value as the reference and select OK. Notice that the statistical mean, min and max have been re-computed to reflect the change of reference.

4 Select **Segment>Define Segments & Clock**.

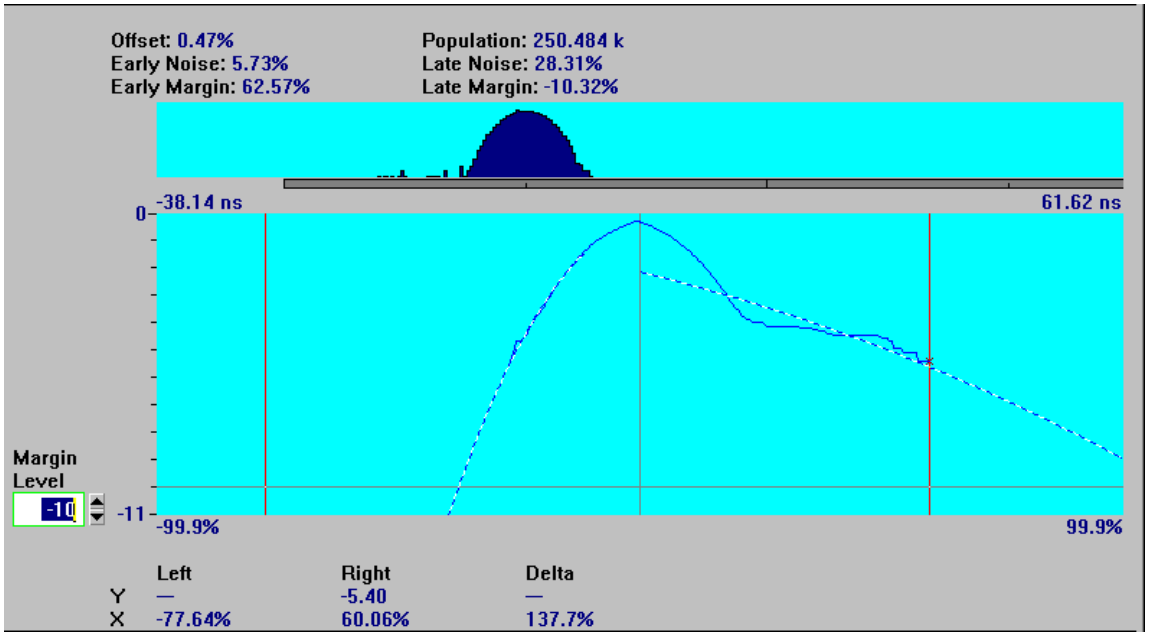
The segment width has been set to 50 ns which is the decode window width for this drive. For data-to-clock measurements, the expected segment center is always ideally zero, so the “1st Segment Center” parameter is grayed out. (Remember, you adjusted for timing skew in the prior step.) The “1st Segment Center” parameter is used for data-to-data measurements. A change in the “Fine Adjust” parameter, will slide the segment by the amount of the entered value. The “Fine Adjust” parameter’s primary purpose is to allow you to experiment with how adjusting the decode window position could affect performance.

The “Total Segments” parameter is also grayed out for data-to-clock measurements because there should ideally be only one distribution. (There is one situation where more than one distribution may occur, it is described in the online help topic “Histogram Displays Split Distribution.”) The software automatically provides the correct number of segments.

Window Margin and Extrapolation Levels

1 Select **Display>Window Margin**.

2 Maximize this window by clicking on the **maximize** ( ) symbol in the upper right corner of the Window Margin window.



These are the corresponding window margin results for the data-to-clock histogram. Due to the incorrect delay from trigger value, the histogram (shown above the window margin) has a number of measured intervals that are set apart from the main distribution. You can see these on the left side of the histogram on the panorama display.

So why does the right side of the window margin show poor performance while the outliers are on the left side of the histogram? What happens when deriving window margin data from data-to-clock histogram intervals, is that the margin plot is reversed, with respect to the segment center from the histogram. This reversal allows the margin data to correctly indicate how the data is varying with respect to the segment center. Of course, with a data-to-clock measurement, both data and clock variations contribute to the end result. This reversal is why the late side of the window margin graph shows poor performance, a consequence of the “errant measurements” on the early side. Note that the extrapolated late margin is –10.32%, indicating that the 10E–10 error rate on the late side is beyond the decode window boundary.

Notice that the break-away in the late side window margin data (due to the errant pulses in the histogram) is causing a poor curve fit for the late portion of the plot. (The dashed line is the extrapolation). While the margin extrapolation algorithm assumes that the distribution is purely Gaussian, this is a case where it is clearly not. You may therefore wish to experiment with fitting or weighting the extrapolation more towards the "tails" of the distribution rather than the center of the distribution. Conversely, you may wish to ignore certain outliers which may be due to media defects, or other known abnormalities. The HP E1741A allows you to modify the data range over which the extrapolation is fitted, as shown next.

3 Click on the right marker, and while holding the left mouse button down, drag the marker on the late portion of the window margin curve to where the data portion of the curve starts to break away; about –3.5 (look at the y-axis, right marker readout at the bottom of the display).

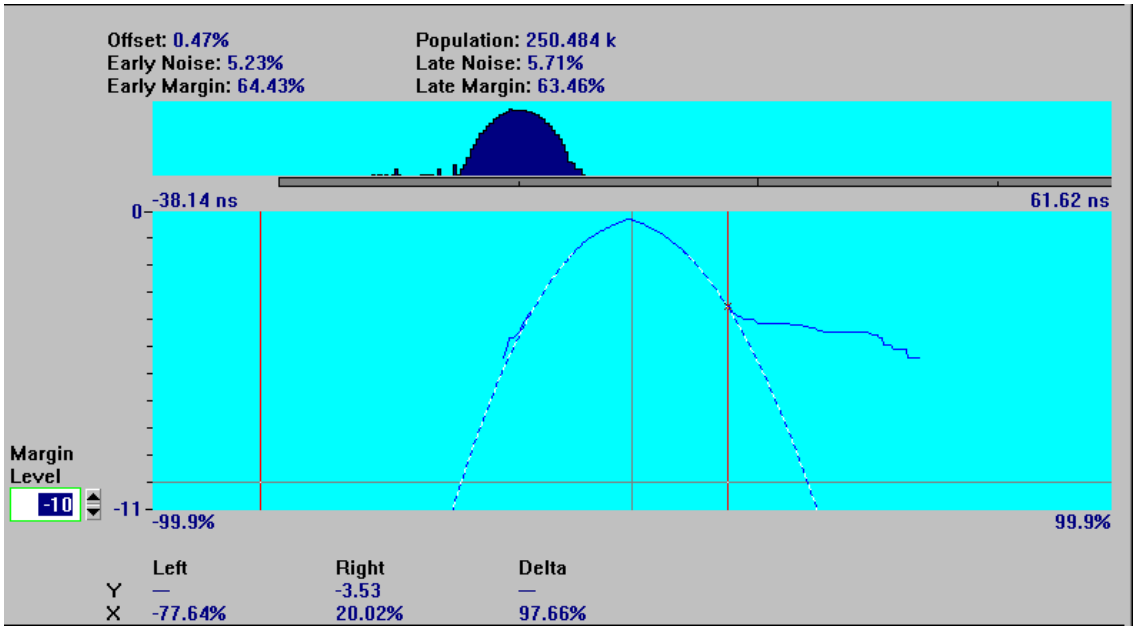
By modifying the default extrapolation values, you will be able to cause the extrapolation to ignore this break-away in the curve.

4 Select **Window Margin>Extrapolation levels**.

5 Highlight the "–**10**" value for the extrapolation.

6 Enter "–**3.5**" and click the **OK** button.

This directs the software to use only error-rate data in the range of $10^{-1.5}$ to $10^{-3.5}$when generating the extrapolation curve.



Notice that the new late window curve fit ignores the break-away in the window margin data and more closely approximates the rest of the acquired data in the window margin curve. The resulting margin is much closer to the early window margin.

While the errors in this demonstration are admittedly contrived, you can see that the HP E1741A offers flexibility to control how the margin data is extrapolated.

7 Restore the window to its original size by clicking on the **return to previous size** ( ) symbol near the upper right corner of the window.

8 Close all of the open windows by selecting **Window>Close All**.

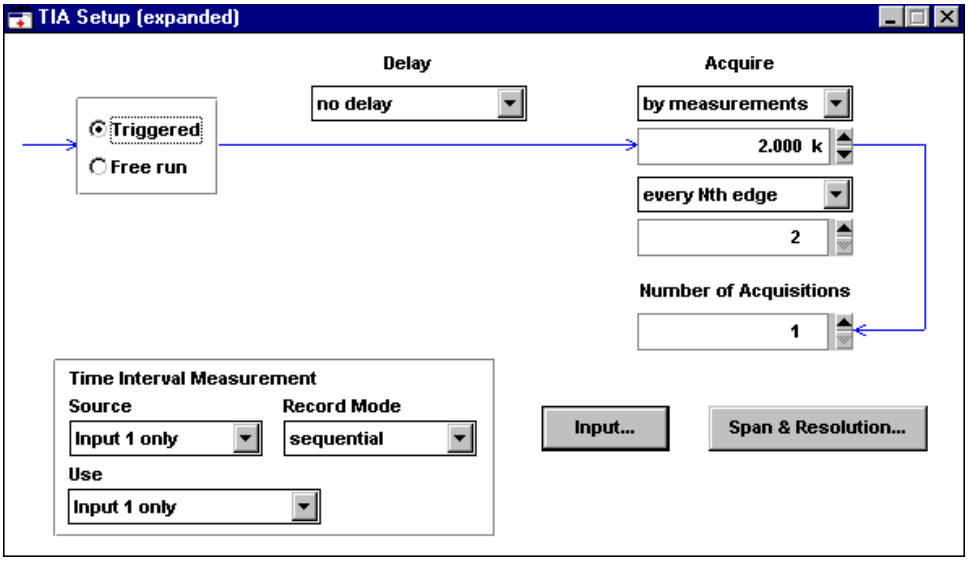
This completes Demo 2.

Demo 3: PLL Frequency Settling

It is often useful to characterize the performance of the PLL or data separator circuitry to determine its lock-up time, jitter, and other dynamic behavior, perhaps as a clue to optimize margin in the design. This demonstration will show the HP E1741A's ability to display the frequency settling characteristic of a PLL. A frequency step was applied to a PLL (not a disk drive PLL, as you will see by the settling time), and the resulting output measured as frequency settling. This data has been stored, and will be recalled for this demonstration. The HP E1741A will display the result as "Frequency versus time."

Start

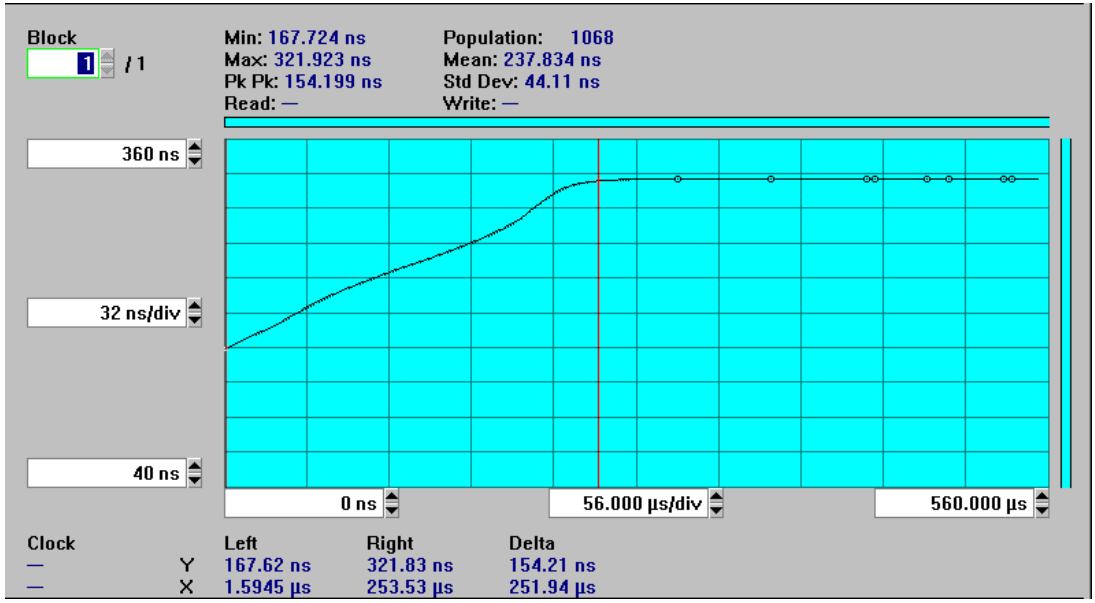
1. Select **File>Use saved data**.
2. Open the demo subdirectory and click on the file "**settle.tid**."
3. Click the **OK** button.
4. Select **Control>TIA Setup [expanded]**.



Review the setup menu for the frequency settling measurement. The HP E1741A is triggered with a voltage step and will gather 2,000 measurements, timing every second data edge. Notice also that the "Record Mode" is set to "sequential." The HP E1741A will record timing information in its 512K sequential memory, as opposed to processing data into histograms on-the-fly as shown in the earlier demos.

5 Select **Display>Versus Time**.

6 Maximize this window by clicking on the **maximize** ( ) symbol in the upper right corner of the Versus Time window.



This is the HP E1741A's "measurement" vs. time display of sequential, or continuous, measurement data. In this example, the display is "time interval vs. time." The markers work much the same as for the histogram display, as you can click on either one with the mouse and drag it to the desired location. Statistical values are presented at the top of the display for the data between the current position of the markers. Marker values and differences are displayed at the bottom of the display.

You can change the scaling and magnification (units/division) by clicking on the corresponding fields on the display and either typing values or scrolling with the arrow keys.

7 Press **F1** to learn more details about the Versus-Time display.

8 Double-click in the upper left corner of the Help window to close it when you are finished.

9 Select **Versus-Time>Frequency**.

The HP E1741A always measures time intervals, actually, the TIA time stamps the signal edges. The Versus-Time display allows you to post-process the acquired data as Frequency, Period, or Time Interval.

Using the markers, you can easily determine the frequency settling time of this PLL.

10 Restore the window to its original size by clicking on the **return to previous size** ( ) near the upper right corner of the window.

11 Close all of the open windows by double-clicking on the upper left corner of each open window.

This completes Demo 3.

Demo 4: Sharing TIA Data

A powerful feature of Microsoft Windows is the ability to share or "cut and paste" data and graphics between various applications. The HP E1741A takes advantage of this feature allowing you to easily share TIA data and graphics with other applications such as spreadsheets (Lotus, Excel, etc.), word processors, and other computational packages such as MathCad. In addition, you can save data to files which can be accessed by programs you write in C, BASIC, etc.

This demonstration will show how easy it is to share the HP E1741A graphics' plots and data with a word processor, such as the Windows' "WordPad" application.

Sharing Graphics

1 Select **File>Use saved data**.

2 Open the demo subdirectory and click on the file "**d-to-d.tid**."

3 Click the **OK** button.

4 Select **Display>Histogram**.

You have retrieved the data-to-data histogram you saw in Demo 1. Suppose you want to integrate this data with a report or your lab notebook.

5 Select **Edit>Copy**.

You have now copied the active window in the HP E1741A to the Windows' Clipboard.

Open the Windows' "WordPad" Program

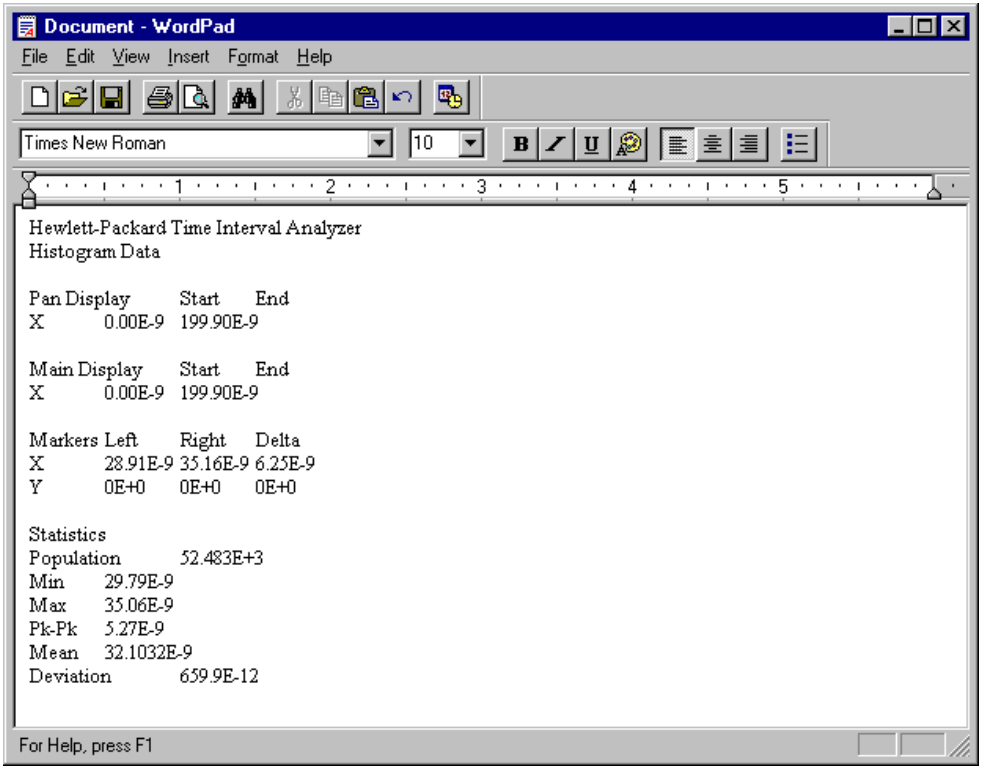
1 Minimize the TIA application by clicking on the **minimize** ( ) button in the top right corner of the window.

2 In Windows 95, click the **Start** button, select **Programs** group, and select the **Accessories** icon.

3 Click on the **WordPad** icon to open this application.

You have now opened the Windows' WordPad word-processor application, and you will see a blank space.

4 Select **Edit>Paste**.



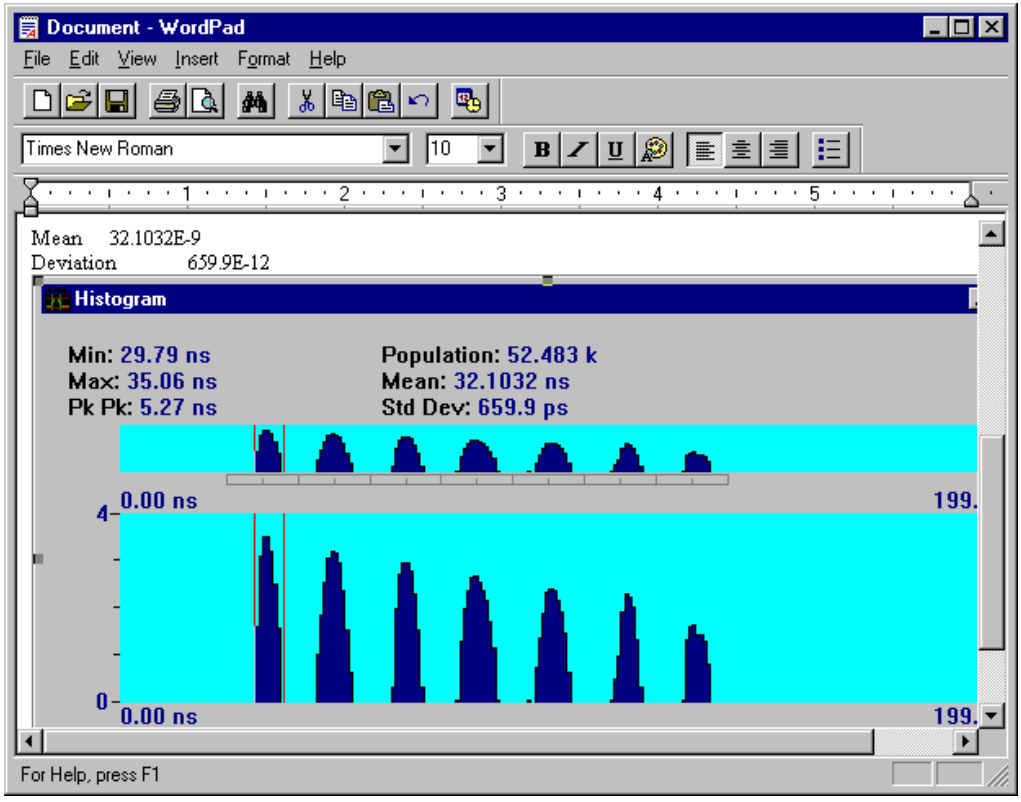
You have now pasted numeric information from the TIA screen, including numeric information on the histogram display, current marker position information, and statistical results.

Now Add the Picture

1 Select **Edit>Paste Special**.

2 Click on **Bitmap**.

3 Click on **OK** button.



You have just copied the bit mapped graphics from the TIA application to the word processor. No scope cameras, and no printers or plotters to worry about.

If you do need to obtain hard copy of any of the HP E1741A graphics, simply copy the selected graphic to the clipboard as shown in this demo and print the clipboard contents on any printer supported by Windows' drivers. An even easier way to obtain a print out of any TIA window is to select **File>Print**.

Sharing Data With Other Applications

Return to the TIA application by double-clicking on its icon, or using any of the other ways this can be accomplished in Windows (Window tool bar selection, ALT TAB, etc.). Currently, the markers are positioned about the 2T distribution in the Histogram display. This procedure will show you how to copy the histogram array data between the markers to another application.

1 Select **Edit>Copy Selected Data**.

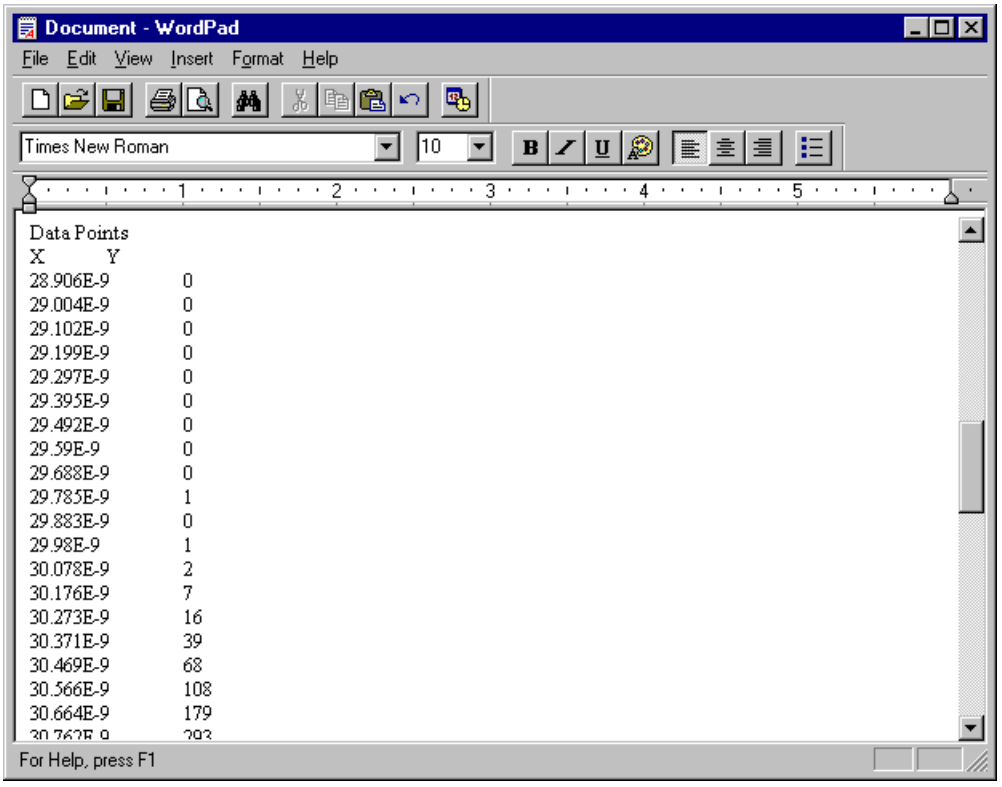
2 Click the button alongside **All between markers**.

3 Click the **OK** button.

You have just copied the histogram data between the current marker positions (the 2T distribution) to the Windows' clipboard.

4 Minimize the TIA application by clicking on the **minimize** ( ) button in the top right corner of the window.

5 Select **Edit>Paste** in the Windows Write application.



You have just copied the current marker and statistical data, as well as the histogram bin values (X values) and their corresponding counts (Y values) between the current markers to the “WordPad” word processor. You may need to scroll the display down to see all of the statistical and histogram data. This type of information could also be shared with a spreadsheet program.

This feature works similarly for sequential data that you may want to copy to another processing program to do custom analysis on continuous time interval data.

6 Close **WordPad** by double-clicking on the upper left corner of the window.

7 If you do not want to save this file, click on the **No** button.

8 Return to the **TIA** application.

9 Select **File>Use live data** if you are ready to start making measurements on actual data.

10 Select **File>Use Synthetic data** if you want to simulate acquiring data as demonstrated in Chapter 3.

This completes the Demos.

5

General Information

5

In this Chapter

This chapter provides information about the following:

- HP E1741A software license agreement
- Unpacking instructions
- Available accessories
- Replacement parts for the HP E1725C

HP E1741A Software License Agreement

Grant of License

This HP E1741A License Agreement (“License”) permits you to use one copy of the specified version of the HP E1741A software product (“Software”) on any single computer, provided the Software is in use on only one computer at any time. If you have multiple Licenses for the Software, then at any time you may have as many copies of the Software in use as you have Licenses.

5

Unpacking and Inspection

Inspect the shipping container and cushioning material for damage. If damage is evident, keep the packing materials until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument or some component fails the performance tests, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection. The HP office will arrange for repair or replacement at HP's option without waiting for a claim settlement.

WARNING **TO AVOID HAZARDOUS ELECTRIC SHOCK, DO NOT PERFORM ELECTRICAL TESTS WHEN THERE ARE SIGNS OF SHIPPING DAMAGE TO ANY PORTION OF THE OUTER ENCLOSURES (COVERS, PANELS, CONNECTORS, LEDS, ETC.).**

Available Accessories

- HP 1181A Testmobile Cart
- HP VXI Oscilloscope:
  - HP E1428A (250 MHz, 1 Gs/s, 2 channels)
  - A wide variety of active and passive probes
  - ScopeView™ software from Decision-Science Applications Inc. for PC control of the oscilloscope. Your HP sales representative can provide information.
- HP DeskJet® and LaserJet® Printers® for color and monochrome hard copy
- HP Vectra® computers, for standalone configurations

Parts Information

This section contains information on how to contact HP for parts information. Only a very brief parts list is presented here.

Contacting Hewlett-Packard

Depending on where you are in the world, there are one or more ways in which you can get parts or parts information from Hewlett-Packard.

- Outside the United States, contact your local HP sales office.
- Within the United States, you are encouraged to order replacement parts or request parts information directly by telephone or mail from the HP Support Materials Organization, using the telephone numbers or address listed below. (You can also contact your local HP sales office.)

By telephone:

For Parts Ordering, use our toll-free number, (800) 227-8164, Monday through Friday (except holidays), 6 am to 5 pm, Pacific Time.

If you need a part in a hurry, extra-cost Hotline phone ordering services are available, 24 hours-a-day. Use the toll-free number above at the times indicated; at other times, use (916) 785-9000 for order verification and (916) 785-3035 for Emergency Service Parts Hotline.

For Parts Identification Assistance, call us at (916) 783-0804. Our Parts Identification hours are Monday through Thursday, 6 am to 3 pm and Friday, 6 am to 2 pm, Pacific Time.

For mail correspondence, use the address below:

Hewlett-Packard Company
Support Materials Roseville
P.O. Box 1145
Roseville, CA 95661-1145

Replaceable Parts

Part Number	Quantity	Description
2110-0054	1	Fuse, 15A, 250 V
8120-5395	1	Line Cord, Heavy Duty US Plug (Option 002 Mainframe)
E1725-90011	1	Getting Started Guide

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Warranty (contd)

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For consumer transactions in Australia and New Zealand: the warranty terms contained in this statement, except to the extent lawfully permitted, do not exclude, restrict or modify and are in addition to the mandatory statutory rights applicable to the sale of this product to you.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

Safety Considerations (contd)

WARNING

ANY INTERRUPTION OF THE PROTECTIVE GROUNDING CONDUCTOR (INSIDE OR OUTSIDE THE INSTRUMENT) OR DISCONNECTING THE PROTECTIVE EARTH TERMINAL WILL CAUSE A POTENTIAL SHOCK HAZARD THAT COULD RESULT IN PERSONAL INJURY. (GROUNDING ONE CONDUCTOR OF A TWO CONDUCTOR OUT-LET IS NOT SUFFICIENT PROTECTION.)

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earthed pole terminal (neutral) of the power source.

Instructions for adjustments while covers are removed and for servicing are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform such adjustments or servicing unless qualified to do so.

For continued protection against fire, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay).
Do not use repaired fuses or short circuited fuseholders.

Acoustic Noise Emissions

LpA<47 dB at operator position, at normal operation, tested per EN 27779. All data are the results from type test.

Geräuschemission

LpA<47 dB am Arbeits platz, normaler Betrieb, geprüft nach EN 27779.
Die Angagen beruhen auf Ergebnissen von Typenprüfungen.

Manual Part Number E1725-90011

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